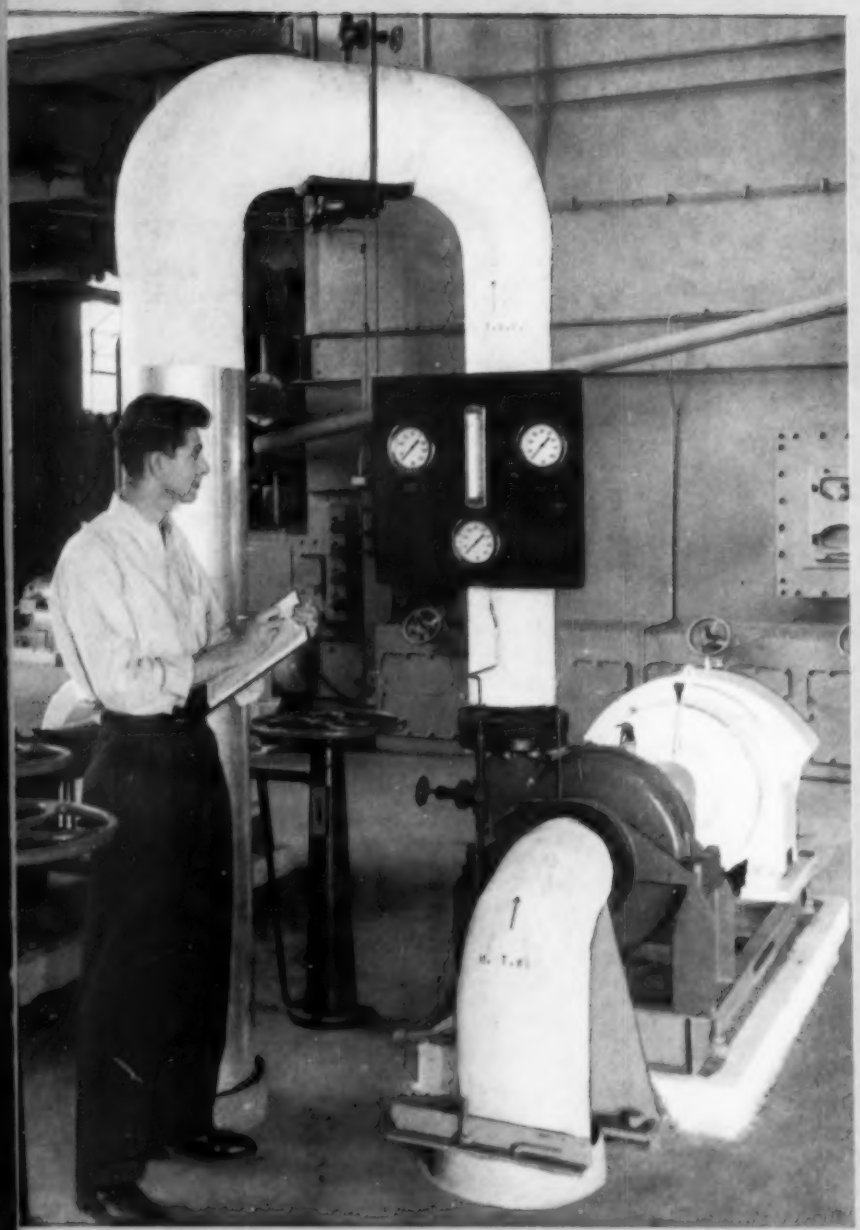
Industry and Power



August 1955

High-temperature water for space-heating proves itself 35

Where do you get your water? Take another look 40

Our first year with the mechanical rectifier 43

Power from waste heat inspires modernization 46

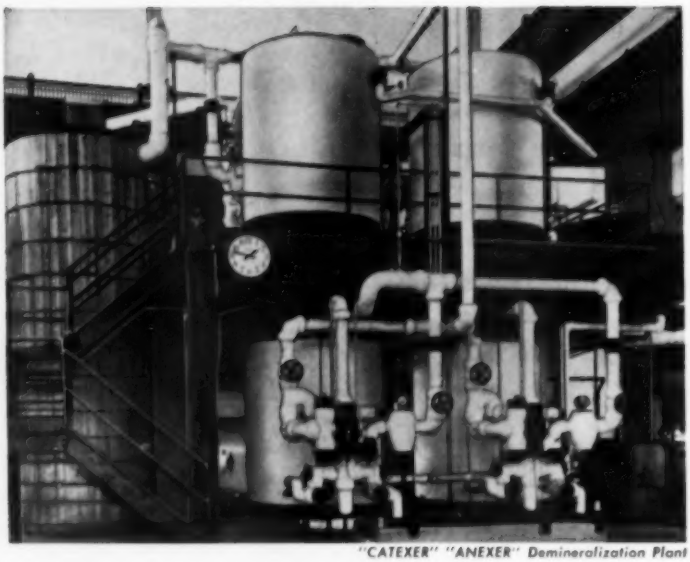
I&P's thermo refresher, Carnot to Rankine 51

Vibration can be tamed, and simply too 55

Why let winter rob you again? Humidify! 60

Lesson for multi-building plants--p 35

Your boiler feedwater problem is different!



"CATEXER" "ANEXER" Demineralization Plant

That is why INFILCO offers you a complete range of water treating plants custom engineered to meet your particular requirements. For example–

If you use high pressure boilers, you might require a CATEXER® ANEXER® Demineralization Plant. These plants give you improved make-up quality, adequate supply regardless of station electrical load, reduced overall operating costs, and lowered maintenance costs and labor expense.

For low pressure boilers, the ACCELATOR® Treating Plant offers a most economical means of treating feedwater. It is also frequently recommended for pre-treating make-up water for high pressure boilers. "ACCELATOR" Clarifiers and Softeners have a proven record of flexibility and ease of operation.

Feedwater for intermediate boiler pressures can often be treated by INFILCO Hot Process Softeners. These softeners are noted for their accurate treatment control and superior performance. They are often used in combination with Hot Process Zeolite Softeners.

"ACCELATOR" Treating Plant

Whatever your feedwater problem, you can depend on the complete engineering know-how and many years experience that have made INFILCO a leader in this field. Why not submit your problem today. INFILCO engineers will suggest a practical solution. Write for information.

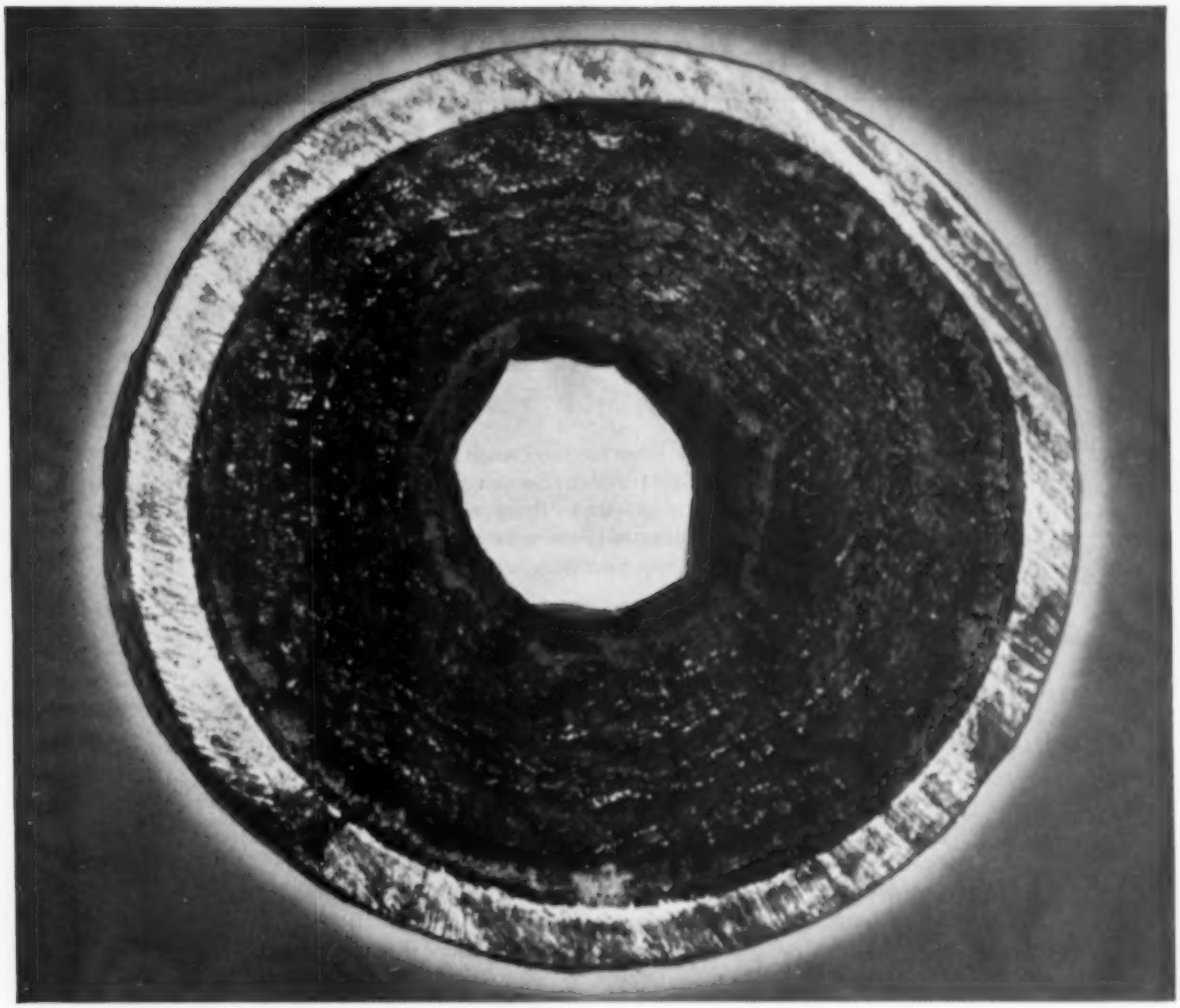
Hot Process Softener

INFILCO

The one company offering engineered equipment for all types of water and waste processing—coagulation, precipitation, sedimentation, flotation, filtration, ion exchange and biological treatment.

INFILCO INC. 911 S. Campbell Ave., Tucson, Arizona
Field offices in principal cities in North America 5527

Circle 107 on READ-N-CIRCLE card for more data



END OF THE LINE

SCALE—layer upon layer of it—has reduced the inside diameter of this pipe to practically nothing. It's a common occurrence in some power plants, and the results are costly. The line must be taken out of service. That means production loss and expensive maintenance or replacement.

Scale, sludge, carry-over, and return-line corrosion are but a few of the problems that must be overcome to assure efficiency in boiler plant operation. In Dearborn's complete line of water conditioning products, there is the correct treatment to eliminate every water trouble—the properly balanced treatment to reduce unnecessary maintenance, avoid shutdowns, and protect valuable equipment.

Since 1887, Dearborn products have provided trouble-free water to users of steam in all types of industry. That's why, today, power engineers in leading industrial plants throughout the nation look to Dearborn for consultation and assistance in solving their water treating problems.

MAIL THE COUPON

Dearborn Chemical Company, Dept. INP
Merchandise Mart Plaza, Chicago 54, Ill.
Please send me complete information on Dearborn Water Conditioning.

Name.....*Title*.....
Company.....
Address.....
City.....*Zone*....*State*.....

Dearborn®

...a leader in water conditioning and corrosion control

Circle 112 on READ-N-CIRCLE card for more data

this month's comment

. . . from industry & power

too much for you to read ? ? ?

An editor-friend of ours has just come out with a new magazine. And what do you suppose our first reaction was (we, of all people) at hearing about it? We held our head between our hands and moaned, "Oh no, not *another* magazine!"

How come such a reaction from we who work in editorial engineering? I think it was simply a reflex reaction. So often we hear—from readers, editors, publishers, advertisers—that "there are just too many magazines." And so when our colleague-in-the-profession launched a new magazine, we fell victim to the trap, parotting what has come to be an ill-advised cliche.

We say "trap" for the reason that, as all traps do, this attitude represents something that is false and misleading. We say "ill-advised" because this attitude too quickly obscures our vision. There are not, in our opinion, too many magazines for you to read. The continuing successes of editors, publishers, and cash-paying advertisers testify to that.

The *true* measure of the situation is, as we see it, that there are indeed too many magazines directed at too many people whose business-professional domain does not coincide with that of the misdirected magazines. We constantly see, for example, too many production magazines foisted on men whose principal domain does not include production activity as such.

Getting back to our friend, we now acknowledge without reservation his place under the editorial sun. Why? Because his new magazine is serving a segment of industry which in itself is new to the business world. Could there be a magazine in the automotive field before automobiles? No! So when business crashes through a new frontier, there is ample justification for publishing enterprise to serve the new frontier. There is no more a limit on the number of business magazines than there is a limit on the number of frontiers that industry will create and conquer. (Of course, there is always room in long-established fields for those who will do a better editorial job than is being done.)

So when the cry arises that "there are just too many magazines to read," the question to be asked is "How many of those 'too many' belong in your 'in' basket in the first place?" It should be easy for you to select those particular magazines that do the best job for you in your field month after month. Quite frankly, we strive to make INDUSTRY & POWER the magazine that gives you maximum quantities of top-grade, usable information per hour of your reading time. Thus do we put claim to the reading time of you whom we aim to serve—and no others do we seek to entice.

Harold A. Bergen, Editor

The John Paul Taylor Publishing Co.
Commercial Bank Building, St. Joseph, Michigan

Industry and Power

Volume 69 **August 1955** Number 2

SPECIAL FEATURES

A lesson for multi-building plants .... HIGH-TEMPERATURE water 35
Alexander Sage, vice president and chief engineer
Charles Simkin & Son, Inc.

Take a second look at where YOU get your WATER .. 40
Albert M. Haley, aircraft division
Twin Coach Company

Our first year with the MECHANICAL rectifier 43
George Duckwall, plant engineer
Hooker Electrochemical Company

While air cleaning efficiency improves .... WASTE heat makes power 46
R. L. Bouldon, Riverside Cement Co.
D. B. Carson, General Electric Co.
J. D. Rosenblatt, Bechtel Corp.

A thermo refresher, IV — from Carnot to Rankine 51
John F. Lee, professor of mechanical engineering
North Carolina State College

Vibration is tamed so simply 55
J. N. Straky, plant engineer
De Soto division, Chrysler Corporation

In brief .... AIEE summer meeting 58

THINK about steam humidification now .... Why let winter ROB YOU again? 59
Donald Hartley, associate editor

MONTHLY FEATURES

this month's comment . 4
nuclear news 6
new equipment 10
new bulletins 22
ideas in action 28
our readers write 32
coming events 66
free bulletins 67
handy guide 75
names make news 80
spot news 84
good books 90
available reprints 91
advertisers' index 92

Established May 1920

John Paul Taylor, *Editor and Publisher*

Harold A. Bergen, *Editor*
Donald Hartley, *Associate Editor*
D. M. Adkins, *Editorial Assistant*
M. J. Holt, *Editorial Assistant*

A. T. Thornycroft, *Manager of Publications*
J. R. Jewell, *Production Assistant*

V. F. Donohue, *Manager of Market Services*
R. H. Gibney, *Reader Service*
L. A. Crabtree, *Circulation*

Sales Representatives

NEW YORK, R. P. Reynolds
11 West 42nd St.,
OXford 5-1495

PHILADELPHIA, D. L. McKechnie
816 Lancaster Ave., Villanova, Pa.
LAwrence 5-4692

CLEVELAND, F. S. Brandt
3292 Daleford Rd., Shaker Heights
SKyline 2-1649

CHICAGO, Tom Barron
360 N. Michigan Ave., Room 614
DEarborn 2-3519

LOS ANGELES, Justin Hannon
4710 Crenshaw Boulevard
AXminister 2-9501

INDUSTRY and POWER including INDUSTRIAL POWER, is published monthly by The John Paul Taylor Publishing Co., Commercial Bank Building, Saint Joseph, Mich. Member of Business Publications Audit of Circulation, Inc. and National Business Publications, Inc. Accepted as Controlled Circulation Publication at Saint Joseph, Michigan. Copyright 1955, The John Paul Taylor Publishing Co. Subscription information: Mailed without charge to executives and engineers, in selected plants and organizations, who are responsible for the selection, installation, operation and maintenance of equipment required for industry's Power Services. To all others there is a subscription price of $10.00 per year in U.S. Outside U.S. subscription price $15.00. Single copy $1.00. Send Form 3579 to Saint Joseph, Michigan.

DEPENDABILITY...

A good coal must be dependable. Unfortunately, dependability is easily overlooked until found wanting.

At our Enos and Enoco Mines...

Two modern tipples have the capacity to produce thousands of tons daily of carefully prepared quality coals. Proven reserves assure abundant supplies for years to come.

That's why you can depend on prompt delivery, uniform size-consist and a life-time supply when ordering Enos or Enoco coals. If you are looking for quality plus dependability,

Place a trial order.
Make a test comparison.

THE ENOS COAL MINING COMPANY

Sales Offices for Enos and Enoco Coals

1405 Merchants Bank Bldg. Indianapolis 4, Indiana
310 S. Michigan Ave. Chicago 4, Illinois

Circle 118 on READ-N-CIRCLE card

nuclear news

. . . about industry & power

INDUSTRY RESPONDS TO POWER REACTORS

In the words of Lewis L. Strauss, AEC chairman, industry's response to the AEC's Power Demonstration Program has been "heartening beyond our expectations." Strauss announces that private and public organizations have proposed building atomic powerplants having a total generating capacity exceeding 700,000 kw at an aggregate cost of $205,000,000. The groups are prepared to put up 90 percent of the costs out of their own pockets, asking only for some small research and development assistance from AEC laboratories. "Indeed," reports Strauss, "one company—Consolidated Edison of New York—is prepared to pay the entire cost, about $55 million to build a nuclear plant with a capacity of 250,000 kw."

ATOMIC POWER—NOT WHETHER, BUT WHEN

It now appears that no single method of extracting power from the atom will prove to be universally satisfactory for all power requirements. This point was made clear by W. Kenneth Davis, director of the AEC's division of reactor development. In fact, he sees the atomic power problem as not "whether we will achieve economic nuclear power—but when we will achieve it." It seems likely, according to Davis, that the total nuclear fuel cost will be at least two mills per kwh. He concludes, "I have every confidence that we will solve the problems of economic nuclear power not only for large central station reactors BUT FOR SMALL POWER REACTORS AS WELL." (Editor's note: capitalized letters are our emphasis.)

ATOMIC BUSINESS TO BOOST AMERICAN ECONOMY

General Electric has come out with the statement that manufacture and sale of atomic power plant components will soon give a substantial boost to the American economy. These components will consist of reactor units, heat exchangers, pumps, valves and fittings, piping, welding, tanks and auxiliaries, coolants, instrumentation, fuel-handling equipment, and auxiliary systems. Eight days after this statement was issued, GE announced "what is believed to be the nation's first coordinated industrial sales program for nuclear research reactors." The seven steps that GE will take in helping its customers obtain and operate reactors are: prepare reactor specifications to meet specific require-

Specify CHAPMAN STEEL VALVES

in any of the Standard Alloys

to meet your steel valve needs

When you specify Chapman Steel Valves you also specify steels designed for your specific services. Standard alloy steels match every normal industrial requirement. Special alloys can be furnished for extraordinary service conditions. All metals are poured in Chapman's own foundries under rigid laboratory supervision.

Exceptionally close machining tolerances are another standard feature of Chapman Steel Valves. Under the most severe conditions, Chapman Steel Valves seat tightly and positively, without jamming, chattering, or wearing excessively. Operation remains smooth and dependable; maintenance costs stay low.

See Chapman *first* for gates, globes and checks in all pressure classes — 150, 300, 400, 600, 900, 1500 and 2500 pounds — and for temperatures to 1150°F. Valves are available with welded, pressure seal, or bolted bonnet joints and with flanged or welding ends. ASA standards are equalled or exceeded in every range. Write for Catalog 20.

THE CHAPMAN VALVE MANUFACTURING COMPANY

INDIAN ORCHARD, MASSACHUSETTS

Circle 140 on READ-N-CIRCLE card for more data

More POWERS to YOU

. . . when you want thermostatic control for showers, heating and air conditioning systems or industrial processes.

Accurate, automatic control of temperature, humidity or pressure pays big dividends. An experienced Powers engineer will gladly help you select the right type for your requirements.

THE POWERS REGULATOR CO.
Skokie, Illinois • Established in 1891
Offices in Chief Cities • See Your Phone Book

Circle 142 on READ-N-CIRCLE card

ments; coordinate building study, assuring proper housing of reactor; prepare hazards summary report to aid in obtaining AEC approval; manufacture reactor on schedule; install reactor system; start up reactor; provide reactor service to maintain reactor system.

CIVILIAN DIVISION ESTABLISHED AT AEC

A Division of Civilian Application staff has just been established in the AEC. Functionally, this division takes over responsibilities for implementing the intent of the Atomic Energy Act of 1954 to encourage "widespread participation in the development and utilization of atomic energy for peaceful purposes." Harold L. Price is director of the new division . . . . Other AEC appointments include those of David F. Shaw as assistant general manager for manufacturing, Louis H. Roddis, Jr., as Deputy of the Division of Reactor Development, and Dr. Frank K. Pittman as Deputy Director of the Division of Licensing.

ATOMIC TRADE FAIR NEARS SELLOUT

Sixty-five American industrial organizations plus a group of United States and foreign government agencies have spoken for all but a very minor portion of the exhibit space available for the first U. S. Trade Fair of the Atomic Industry to be held September 26 to 30 under the auspices of the Atomic Industrial Forum. The Fair is being held in conjunction with the annual fall meeting of the Forum and sessions of the American Nuclear Society.

UNITED STATES EXHIBITS AT GENEVA

The International "Atoms-For-Peace" Conference now running at Geneva will see exhibits from some 150 United States firms and organizations. Eighty-three firms have contributed to the official United States technical exhibit. Others are contributing to a United States Information Agency "teaching" exhibit and to an Atomic Trade Fair. More than 100 American periodicals (including INDUSTRY & POWER) will be displayed.

FIVE MILLION KWH FROM ATOM ALREADY

Westinghouse reveals that the first two atomic submarine powerplants it has built for the AEC have been generating the first substantial quantities of atom-produced electricity to the tune of five million kwh. The first plant went into operation on May 31, 1953 on the Idaho desert. The second is installed in the U.S.S. Nautilus, the atomic submarine that went to sea January 17, 1955.

are man-hours slipping through your fingers?

P-A-X "inside" communication cuts this loss

P-A-X provides instant, person-to-person communication, anywhere within your organization.

When your people are walking about to exchange information, they're *wasting time.* What you need is a P-A-X Business Telephone System, to provide communication—in *seconds*—between all parts of your plant. The P-A-X system makes it easier to supervise and coordinate all operations, and maintain top efficiency.

Rent-free P-A-X systems are privately owned and controlled—your own maintenance men install and move P-A-X telephones as you wish. Entirely separate from the public telephone system, P-A-X gives you lightning-fast service, always—no matter how busy the city switchboard may be.

Discover how other companies similar to yours are saving time and increasing efficiency, with a P-A-X Business Telephone System. For an actual "on-the-job" case study, *write:* Automatic Electric Sales Corporation (HAymarket 1-4300), 1033 West Van Buren Street, Chicago 7, Illinois. *In Canada:* Automatic Electric Sales (Canada) Ltd., Toronto. *Offices in principal cities.*

AUTOMATIC ELECTRIC

ORIGINATORS OF THE AUTOMATIC DIAL TELEPHONE

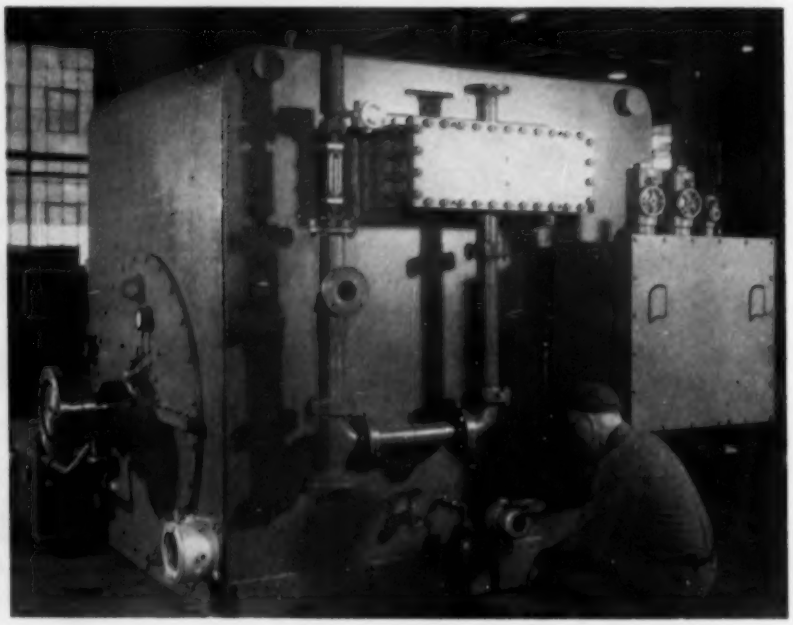
Circle 111 on READ-N-CIRCLE card for more data

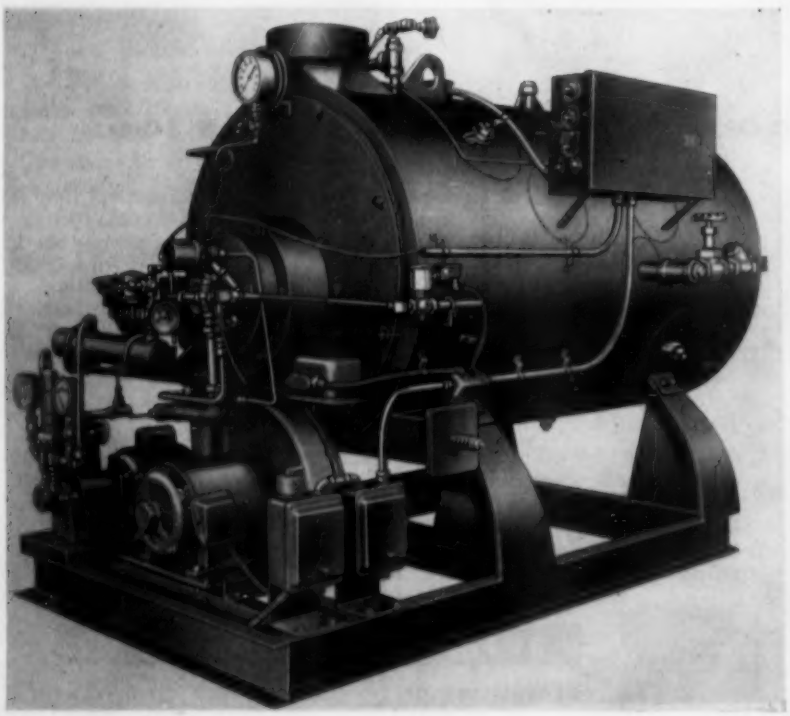
new equipment

. . . just circle key numbers on READ-N-CIRCLE card on page 75

700-Inert gas-filled motors in wide ranges for hazardous areas

Totally-enclosed, inert gas-filled motors in a wide range of ratings for safe operation in hazardous gas-contaminated areas are now available. Gas-filled enclosures use air-to-water surface heat exchangers to remove the heat of motor losses. Inert gas, under positive pressure inside motor, keeps out explosive ambient gases. Specially constructed plate-steel stator yokes and seals on shaft extensions reduce gas leakage to a minimum. Pressurizing manifold maintains positive pressure within the housing. Other special equipment includes explosion-proof instrumentation for temperature indication, liquid level alarm, and water flow. Refineries are already using 3000-hp, 2300-volt, 1800-rpm units to drive high-speed centrifugal compressors. ALLIS-CHALMERS MANUFACTURING COMPANY.





701-Small boiler burns cheaper oil, good for wide load variations

Compact 50-hp steam generator designed to burn No. 4 oil cuts fuel costs as much as 30 percent and operates at 80-percent efficiency or better. The unit can be installed in 20 square feet of floor area, and is completely packaged. Multiple installations are particularly worthwhile in plants that experience wide variations in steam load. CYCLOTHERM DIVISION, NATIONAL U. S. RADIATOR CORPORATION.

FREE INFORMATION

For detailed free information on these products just circle the key numbers on the READ-N-CIRCLE card on page 75.

702-Positioner relay kit solves valve problems

Valve positioning problems—such as stuffing box friction load, poor response, unbalanced inner valves, hysteresis, and undesirable regulating characteristics—can now be solved

BETZ • *A Great Name In Water Conditioning*

Consulting is a full time job, too!

In our continuing efforts to engineer sound water conditioning for industry, our service activities extend into many phases of this exacting field.

The Betz Consulting Division, for example, is typical of the completeness and diversification of the service we offer.

This separate unit of the organization, staffed with qualified chemical, mechanical and sanitary engineers, provides full-scale engineering services on a variety of problems relating to the *external* conditioning of industrial water for process, cooling, and boiler feed requirements, and the treatment of industrial waste and sewage.

Whether the water or waste problem is of broad or limited scope, the Betz Consulting Division matches *service* to *need* through its many activities such as

. . . economic and technical surveys . . . chemical engineering research . . . pilot plant design and operation . . . equipment specification and procurement . . . process design and supervision . . . start up operation . . . continuous supervisory service.

This specialized consulting service is *another* reason why Betz continues its leadership in providing completely-integrated engineering on all water problems.

Ask a Betz District Engineer the next time he calls how Betz Consulting Service can help you solve *your* water problem. He'll be happy to provide the details.

W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: BETZ Laboratories Limited, Montreal 1.

BETZ

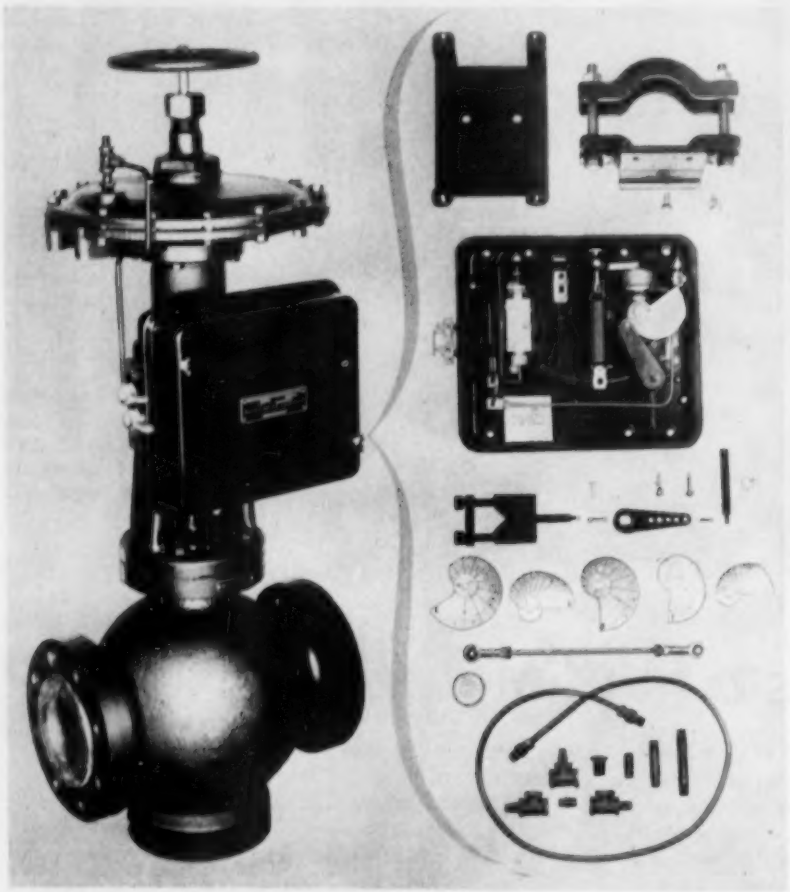
CONSULTANTS ON INDUSTRIAL WATER PROBLEMS

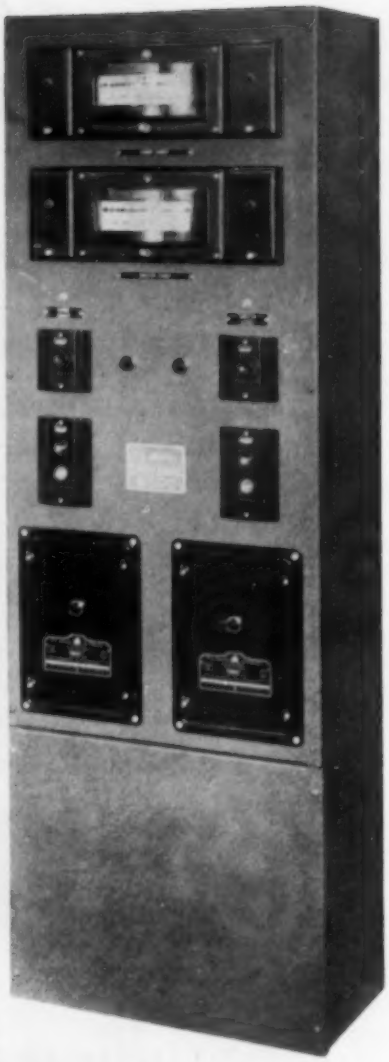
Circle 146 on READ-N-CIRCLE card for more data

new equipment

. . . starts on page 10

with a new positioning relay kit, available for field application to any air-operated control valve. Standard SAMA signal ranges of 3 to 15 psig or 3 to 27 psig actuate a force-balance mechanism. Relay is direct or reverse acting and suitable for top- or bottom-connected valves. Six pre-shaped cams are included for square root, linear, square, and half-travel regulating characteristics. BAILEY METER COMPANY.



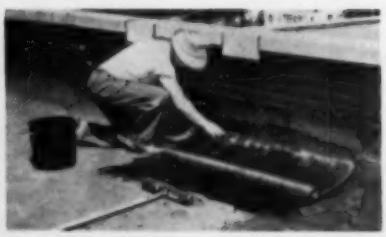


704-Control center for pathological incinerators

New control center for pathological incinerators ensures that temperatures within the incinerator are within the limits 1600 F to 220 F. The controller is used along with necessary combustion safeguards and starting switches. A simple manual switch allows maintenance of a constant 1600 F when the incinerator is not being charged. Unit chassis construction facilitates inspection and servicing of the temperature measuring and control components. Adjustments and settings are made

703-One-coat roofing fabric goes right on with roof coating, eliminates rippling

Improved reinforcing fabric for use with roof coating is made with a wider weave, which enables it to be laid right on the old roof. Coating is then applied and flows through to bind the fabric firmly to the surface below as well as providing a protective coat. Its increased weight and body enables the material to be laid flat without bagginess or rippling. It doesn't float in the roof coating. Particularly suitable for one-coat roof repair jobs. Its flexibility enables it to be fitted



snugly around corrugated surfaces and into sharp corners. THE MONROE COMPANY, INC.

FREE INFORMATION

For detailed free information on these products just circle the key numbers on the READ-N-CIRCLE card on page 75.

STRENGTH

for Safety and Long-Time Service

For 2000, 3000 and 6000 pounds service — Sizes 1/8" to 6"

SCREW END TYPE

For schedules 40, 80 and 160 pipe — Sizes 1/8" to 4"

SOCKET WELD TYPE

Vogt Ells, Tees, Crosses, etc., are forged from carbon steel or various alloys to meet specific operating conditions. Catalog F-9 will aid you in their selection and proper application.

Shocks and stresses imposed by high pressures and high temperatures are taken in their stride because Vogt fittings are uniform in structure, fine grained, and free from porosity . . . the superior product of laboratory controlled materials and giant forging hammers and upsetters. These properties also give higher resistance to erosive and corrosive conditions, thereby adding to service life expectancy in steam plants, petroleum refineries, chemical plants and related industries

HENRY VOGT MACHINE CO., INC.
Louisville 10, Kentucky
BRANCH OFFICES: NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO • DALLAS

Vogt

DROP FORGED STEEL FITTINGS

Circle 133 on READ-N-CIRCLE card for more data

new equipment

. . . starts on page 10

from the front of the control center alongside the large temperature indicating scale. WHEELCO INSTRUMENTS DIVISION, BARBER-COLMAN COMPANY.

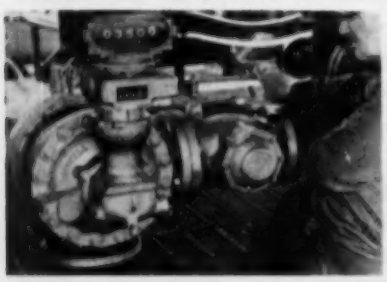
705-New rugged transformer for relays and controls

This new transformer has extra-high mechanical and thermal ratings to adapt it for relay and control device operation. It is designed for use on circuits not exceeding 5000 volts, line-to-line, and is available in all stand-

ard, single, primary-current ratings from 15 to 800 amperes. The transformer is molded of Butyl and is suitable for continuous operation at 100 percent of rated current in 55 C ambient temperature. GENERAL ELECTRIC COMPANY.

706-All-bronze meters eliminate contamination

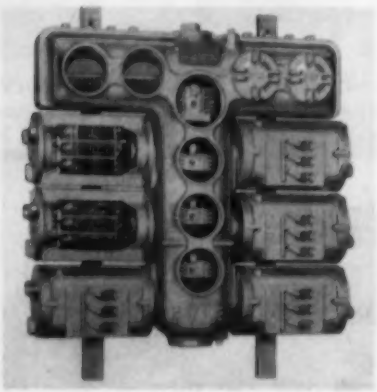
All-bronze rotocycle meters are now available for metering alcohols, brine, water, ketones, and products which must be discoloration and contamination free. Available in 2-, 3-, and 4-



inch bulk models. Flow rates range from 20 to 500 gpm. Even large flows can be shut off at a predetermined volume without harmful hydraulic shock when the meter is equipped with a bronze multistage quantity control valve. Other available accessories include remote registration systems, reading registers, strainers, air eliminators, temperature compensators, impulse contactors, swivel adapters, and angle adapters. METER AND VALVE DIVISION, ROCKWELL MANUFACTURING COMPANY.

707-Cast aluminum circuit-breaker panelboard is explosion proof

Cast aluminum circuit-breaker panelboards for hazardous locations have a triple-sectioned grooved joint that meshes cover, end plate, and body to form a continuous metal-to-metal explosion-proof seal. Three turns of end plate releases cover, which lifts off to allow complete visibility and quick access to branch circuit break-



ers and all factory-made connections. Available in 2-, 4-, 6-, and 8-gang types, the panel-boards take E-frame circuit breakers with from 2 to 24 branch circuits. THE PYLE-NATIONAL COMPANY.

708-Lightweight acoustical baffle is easily installed

Low cost, lightweight acoustical baffle, that reduces reflected noise up to 60 percent, has a unique wedge-shape. It can be installed easily without interrupting production. It can be hung low to trap noise near the source, or high to catch reflected sound. Baffle is incombustible, verminproof, rotproof, and impervious to bacteria and mold. It will not dust or crumble. Available with foil face for high light reflectivity and cleanability, or plain for maximum economy. Wedge shape makes the new baffle ideal for installation where lighting, ventilation, sprinkler heads, and so forth prevent

a continuous sound-absorbing material application. L. O. F. GLASS FIBERS COMPANY.

FREE INFORMATION

For detailed free information on these products just circle the key numbers on the READ-N-CIRCLE card on page 75.

709-Tubeaxial fans for handling corrosive exhausts

Belt-driven tubeaxial fans are available in five sizes from 16 through 36 inches. Designed for handling cor-

rosive exhausts, high-temperature explosive fumes, and similar rugged air-moving applications. Their delivery ratings go to 26,000 cfm. Motor-mount assembly permits three-inch

I-T-E URELITE AIR CIRCUIT BREAKERS PERFORM THESE 2 IMPORTANT FUNCTIONS:

- **provide sure protection against harmful overloads and other faults in individual circuits**
- **provide sure protection of personnel against injury from accidental contact**

Protection of individual circuits against harmful overloads and other faults pays off in a minimum of downtime: production is steadier, profits higher. Protection of personnel pays off over and above the human values: increases production, lowers insurance rates. The safety offered by I-T-E Urelites is complemented by simplicity of design, ease of operation, economy of maintenance.

I-T-E Urelites are available through your local I-T-E distributor in four types of enclosures: general purpose, panel-mounted, weatherproof, and dustproof; and with auxiliary and tripping devices to fit specific applications. Ask him for literature or, if more convenient, write I-T-E Circuit Breaker Company, 19th and Hamilton Sts., Philadelphia 30, Pa.

I-T-E Type KA. 15,000 amp interrupting capacity. 15-225 amp continuous. 600 v a-c, 250 v d-c. 2, 3 and 4 pole.

I-T-E Type KB. 25,000 amp interrupting capacity. 40-600 amp continuous. 600 v a-c, 250 v d-c. 2, 3, 4 pole.

I-T-E Type KC. 50,000 amp interrupting capacity. 200-1600 amp continuous. 600 v a-c, 250 v d-c. 2, 3 and 4 pole.

I-T-E Type LG. 75,000, 100,000 amp interrupting capacity. 2000-6000 amp continuous. 600 v a-c, 250 v d-c. 2, 3 pole.

I-T-E

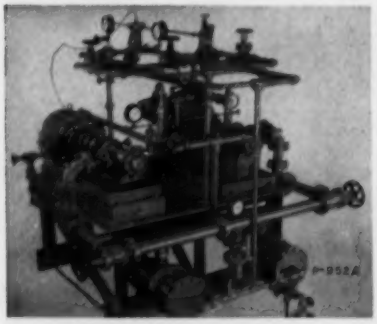
I-T-E CIRCUIT BREAKER COMPANY

SWITCHGEAR DIVISION

Circle 114 on READ-N-CIRCLE card for more data

COMPLETE RANGE OF SIZES AND MODELS IN BOTH MEDIUM AND HIGH PRESSURE TYPES

MORE COMPACT THAN EVER . .



P-952-A—Steam Turbine and Electric Motor drive gives flexibility in this compact Model P-852H size No. 25 unit.

NATIONAL AIROIL

FUEL OIL PUMPING AND HEATING UNITS

NATIONAL AIROIL Fuel Oil Pumping and Heating Units are specially designed to prepare, for combustion, all grades of fuel oil including No. 6 or Bunker "C" Oil and residuums. They will draw fuel oil from above ground or underground tanks, preheat it to proper constant temperature and deliver it to Oil Burners at an even pressure, best suited for the burners. Our Fuel Oil Pumping and Heating Units are the result of years of experience. They come completely equipped ready for steam, exhaust, condensate, oil suction, oil return, and electrical connections. All valves, regulators, etc., are readily accessible. The piping arrangement is easily understood. These compact, space-saving units are available in a range of sizes and models in both Medium and High Pressure types. For complete details, write for our Bulletin 40—very interesting and informative.

OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes
STEAM ATOMIZING OIL BURNERS
SLUDGE BURNERS, Steam Atomizing
MOTOR-DRIVEN ROTARY OIL BURNERS
MECHANICAL PRESSURE ATOMIZING OIL BURNERS
DUAL STAGE, Combining Steam and Mechanical Atomization
LOW AIR PRESSURE OIL BURNERS
AUTOMATIC OIL BURNERS, for small process furnaces and heating plants
GAS BURNERS
COMBINATION GAS & OIL BURNERS
FUEL OIL PUMPING and HEATING UNITS
FURNACE RELIEF DOORS
OBSERVATION PORTS
SPECIAL REFRACTORY SHAPES

NATIONAL AIROIL BURNER CO., INC.

1391 E. Sedgley Avenue, Philadelphia 34, Pa.
Southwestern Division:
2512 South Boulevard, Houston 6, Texas

Circle 121 on READ-N-CIRCLE card

new equipment

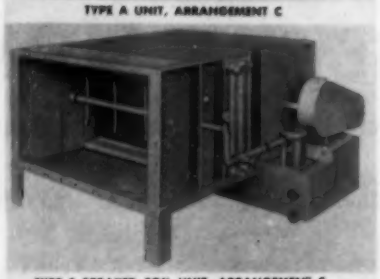
. . . starts on page 10

belt adjustment and will accommodate any motor from ¼ to 5 hp at 1725 rpm. Propellers are cast from special aluminum-magnesium alloy to provide high tensile and shock strength and dimensional stability. New blades have airfoil section design to assure maximum efficiency and higher horsepower savings. One-piece rigid cast-iron housing isolates fan bearings from air stream. Special corrosion resistant coatings are available. ROBBINS & MYERS, INC.

710-Industrial air conditioners have wide capacity ranges

Complete central-station, cabinet-type air conditioning units that are compact, simply installed, and have a flexible design are available in ranges from

TYPE A UNIT, ARRANGEMENT C



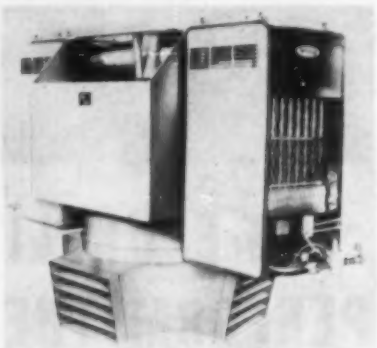
TYPE S SPRAYED COIL UNIT, ARRANGEMENT C

TYPE AB MULTI-ZONE CONDITIONER

600 to 48,000 cfm. Three basic types of units are available: air conditioning units, sprayed coil conditioning units, and multi-zone conditioner units. All units have large-volume, slow-speed fans. Cooling and dehumidifying can be done with water, direct-expanded refrigerant, or brines. Heating can be with steam or hot water. All bearings, connections, motors, and drives are outside the units for maximum accessibility. Manual or automatic controls can be provided. AMERICAN BLOWER CORPORATION.

711-Ceiling-suspended gas-fired unit heaters are self-contained

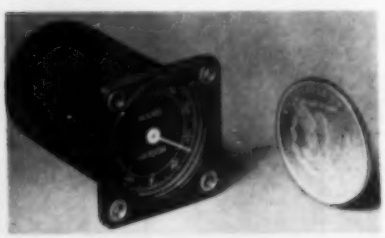
Completely self-contained heating units combining gas burners, combustion chambers, and heat exchangers, with motor-driven fans, and fixed or revolving discharge outlets are now available for ceiling suspension. Automatic safety controls are provided. Presently available with an



input capacity of 430,000 Btu per hour, other sizes will be added soon. Revolving discharge outlets eliminate a steady blast of hot air and send the heat downward in a gently moving airstream that covers the entire working area. AGA approved. L. J. WING MFG. CO.

712-Running-time meter is hermetically sealed

A running-time meter that indicates up to 10,000 hours of operation on a dial-type face meets severe shock



and vibration requirements. Unit is only 1½ inches in diameter by 2¾ inches long. It mounts with screws either behind or in front of a panel.

Electrical connections are in back. Concentric hands give readings on a clock-type dial. Small unit weighs only six ounces and operates on 115-volt, 60-cps, a-c current. Also available with external pointer that can be set to show operational hours before next overhaul. HAYDON MANUFACTURING CO.

FREE INFORMATION

For detailed free information on these products just circle the key numbers on the READ-N-CIRCLE card on page 75.

713-Valves for supercritical applications

Forged steel valves—rated 7250 psi at 700 F, or 10,800 psi at room temperature—are now available as a result

of research on valve behavior under supercritical conditions. EDWARD VALVES, INC.

714-Hose clamp easily attached in three seconds

Lasting and positive clamping action under extremes of pressure, movement, and usage is assured with a

general-purpose hose clamp that is fixed in place with ordinary pincers. Clamp is round with U-shaped folds or lugs. Device is merely slipped on

Your plant and equipment suffers . . . your community goodwill fades away. These problems can be solved. Prat-Daniel Collectors are designed for the control of industrial dusts and flyash. Multiple small diameter tubes provide powerful centrifugal forces, resulting in sustained high collection efficiency . . . even with ultra-fine dusts.

Whether the problem is industrial dust or flyash, you are assured of satisfaction with P-D Collector Systems, engineered to meet your specific needs.

Write for Reprint No. 102 titled, "What Type Collector?"

pd

Project Engineers
THE THERMIX CORPORATION
GREENWICH, CONN.
(Offices in 38 Principal Cities)
Canadian Affiliates: T. C. CHOWN, LTD., Montreal 25, Que.; Toronto 5, Ont.

Designers and Manufacturers
PRAT-DANIEL CORPORATION
SOUTH NORWALK, CONN.
POWER DIVISION: Tubular Dust Collectors, Forced Draft Fans, Air Preheaters, Induced Draft Fans, Fan Stacks

Circle 101 on READ-N-CIRCLE card for more data

new equipment

. . . starts on page 10

hose and crimped in place by squeezing the parallel sides of the lugs together with pincers. To remove the clamp, lugs are simply snipped off. Available in various ferrous and nonferrous metals, in 20 sizes ranging from ¼-inch ID to 2⅝-inch ID. CIRCLE CLAMP CORPORATION.

715-Double-wrap protection from single-wrap coal tar tape

Double-wrap protection with single-wrap application is now possible with the use of a new coating, Tapecoat-X. The new tape permits single wrapping with ½-inch overlap in contrast to the regular method of overlapping slightly more than half the tape width. This makes for greater cov-

erage. Other advantages are easier application through the use of an exclusive separator film which facilitates unrolling, faster wrapping, and reduced material cost. Available in rolls of 2-inch, 3-inch, 4-inch, and 6-inch widths. TAPECOAT COMPANY.

716-Gasoline-driven generator-type welders are compact

Available in current ranges of 30 to 350 amperes, ac or dc, the welders in this new line are compact, self-powered, and may be equipped with optional running gear. Air-cooled, four-cylinder, 20-hp gasoline engine has electric starting, and an internal fly-ball governor with variable-speed control attachment. Dual-purpose d-c model handles all types of d-c welding and can be converted into an a-c power plant by a conversion switch. A-c model has a 110-volt, d-c outlet

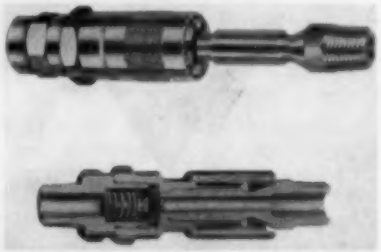
for operating universal drills and lights. Another model is equipped with high frequency for Heliarc inert gas welding. All models have infinite current adjustment steps. WESTINGHOUSE ELECTRIC CORPORATION.

FREE INFORMATION

For detailed free information on these products just circle the key numbers on the READ-N-CIRCLE card on page 75.

717-Quick coupling has more coupling area

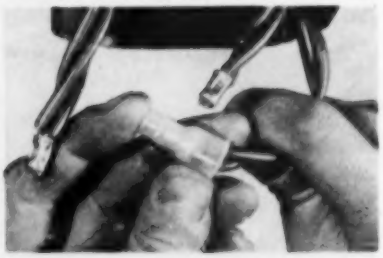
Modified collet principle is used for instant locking and unlocking of this coupling, which is available from



stock. When the coupling is engaged, it is free to swivel and yet holds 80 percent of the plug shoulder in complete contact with the collet fingers. Lightweight, small diameter, and foolproof engagement even under adverse conditions make the coupling suitable for joining two hose ends, attaching hose to another object, connection of metal tubing or pipe, vaportight electrical connections, and connecting flexible shaft and rod ends. Many styles of threaded ends and hose attachments are available. R. S. CORCORAN COMPANY.

718-Splice cap insulator is easily installed

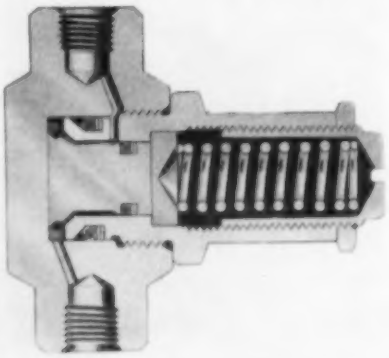
Snap-on-lock nylon splice cap insulators provide perfect insulation of wire splices and easy installation, even on very flexible wires and in extreme temperature ranges. Eliminates threading, wrapping, or twisting of insulator during installation, and any



possibility of its loosening in service. Available in two sizes for use with two sizes of splice caps for wiring from two No. 18's through three No. 8's or two No. 6's. U/L approved for building wire to 600 volts, and in fixtures to 1000 volts. BUCHANAN ELECTRICAL PRODUCTS CORPORATION.

719-Cartridge-type gage protector is adjustable

Gage protector has a spool-like plunger within a removable cartridge. Connections are in-line. Spring pres-



sure adjustments or changes of cartridge may be made without removing from the line. For use in hy-

How to Select an Economical Temperature Regulator

First of all, what does economy mean where temperature regulators are concerned? In some industries it means improvement of product or reduction of spoilage through closer control of process temperatures. In others, it means the paring down of operating expense. The price of the regulator itself is a relatively small factor.

Today's buyers are shopping for:

1. Accuracy of control — not only when the regulator is new, but throughout its service life
2. Dependability — to prevent loss of production time
3. Minimum installation and maintenance cost

Here are a few tips on what to look for when you're installing a new or replacing an old temperature regulator —

Packless construction . . . and for this reason: A diaphragm operated, packless regulator minimizes friction. There are no closely fitted parts to stick or bind because of uneven expansion or collection of foreign matter. Also, there's less maintenance, since no repacking is ever required.

A guarantee against wire drawing of the seats and discs. Insist on it. This guarantee in combination with single seat design assures you of tight shutoff; you avoid expensive steam losses as well as loss of product in a process application.

Broad control range. In a standard regulator you should expect a control range of 100 F. And make sure the unit you select has a vapor tension thermostat that can take over-temperatures of at least 100 F.

Easy maintenance. Why ask for grief? Your temperature regulator should be basically simple in design so that it can be serviced by average plant personnel. All parts should be readily accessible for testing and cleaning.

Double duty. There's no point in buying a separate pressure regulator when you can select a temperature regulator that combines both temperature and pressure control within the same unit.

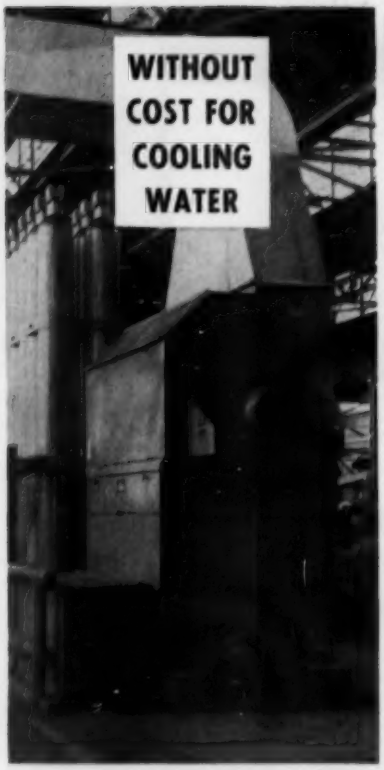
Self-operating. Make sure you get a regulator that operates on its own initial pressure. By doing so, you avoid the purchasing and maintenance of an air compressor plus air piping, and you're sure of uninterrupted operation during electric power failures.

• • • •

All of these points are important to you when it comes to selecting an economical temperature regulator. Perhaps you didn't realize you *could* expect so much. And perhaps you didn't realize that Spence Temperature Regulators offer all these features and more. May we send you our Bulletin T500 containing further details?

SPENCE ENGINEERING COMPANY, INC.
Walden, New York

Circle 143 on READ-N-CIRCLE card for more data



ACCURATE TEMPERATURE CONTROL of Hydraulic Liquids PREVENTS LOSSES

• This NIAGARA AERO HEAT EXCHANGER cools the liquid for a large hydraulic press, preventing heat damage to the pump stuffing boxes. Using outdoor air as the evaporative cooling medium, it removes the heat at the rate of input (1,875,000 BTU/hr.) with no cooling water consumption except a negligible amount evaporated.

Similar Niagara machines cool water, oils, solutions, lubricants and coolants for many mechanical, electrical and chemical processes. In a closed system, your coolant is never contaminated. The system is simple and easy to keep up; the equipment has a long, useful life.

Write for Bulletin 120 for a complete description

NIAGARA BLOWER COMPANY

Dept. I. P., 405 Lexington Ave.
NEW YORK 17, N. Y.
District Engineers in Principal Cities of United States and Canada

Circle 124 on READ-N-CIRCLE card

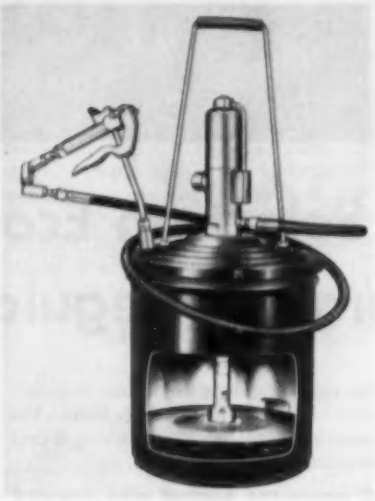
new equipment

. . . starts on page 10

draulic systems up to 10,000 psi. Plunger shuts off gage instantly when line pressure reaches spring setting. Opens immediately when pressure returns to normal. Springs are available for standard maximum gage readings from 15 to 5000 psi. Standard body materials are aluminum and stainless with ¼-inch line port. REPUBLIC MANUFACTURING COMPANY.

720-Air-operated lubrication gun pumps from pails.

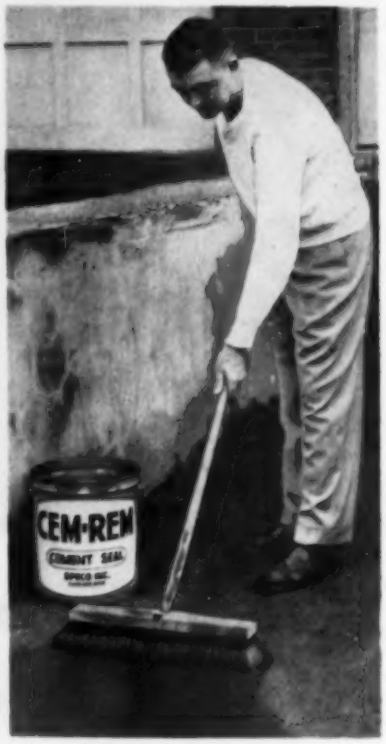
Portable power gun delivers up to 14½ ounces of lubricant per minute, pumping directly from original 25- or 35-pound pails of lubricant. Unit develops a pressure ratio of 40 times the air pressure used. Completely elim-



inates transferring and loading operations. Eliminates wastage by completely emptying the pail. Easily fitted cover completely seals the lubricant against dirt and contamination. Unit weighs only 12½ pounds. ALEMITE DIVISION OF STEWART-WARNER CORPORATION.

721-Single-coat liquid protects and preserves concrete

One-coat liquid seal that protects and preserves concrete surfaces, indoors and out, is ideal for use on both old and new concrete. CEM-REM is easily applied with mop, brush, squeegee, or sheepskin applicator. Coated surfaces can be opened to traffic four hours after application. On new concrete, the seal holds moisture beneath the surface, prolongs the curing period, and helps prevent surface powdering. On old concrete, the seal



forms a smooth, durable coating, reduces dusting, and prevents water entering minute cracks. Available in green, dark grey, red, and clear. SPECO, INC.

722-Tube replacement made easier

New tube pilot consists of a hardened steel nose with a replaceable nylon brush attached for piloting tubes through tube sheet and tube support

plates. Brush fits snugly in the end of the tube, centering and holding the pilot firmly in place. Easily removed from the tube by a slight twist. The

brush also cleans the tube where it will be rolled. Pilots are available for tubes 1¼ inch and smaller. ELLIOTT COMPANY.

FREE INFORMATION

For detailed free information on these products just circle the key numbers on the READ-N-CIRCLE card on page 75.

723-Portable stroboflash measures speeds to 100,000 rpm

Special neon tube gives an extremely short flash so that very sharp images are obtained when measuring speed with this new portable stroboflash. Direct reading scale is 250 to 18,000 rpm in three overlapping ranges with an accuracy of ± 1 percent. Speeds

outside this range can be measured by using multiples of the flashing speed. Flash duration is between 10 and 15 micro-seconds. Weighs approximately 15 pounds. HICKOK ELECTRICAL INSTRUMENT COMPANY.

724-Small gear motors are versatile

Small gear motors made in the NEMA 42 frame are available in 1/20- and 1½-hp ratings. Eight

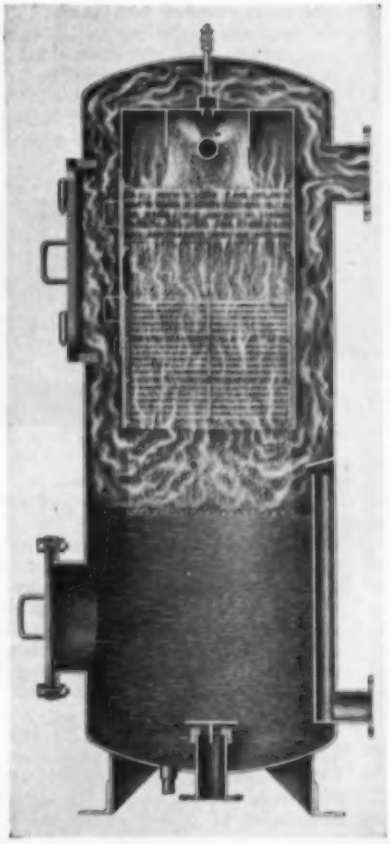
standard ratios in the range of 5:1 and 60:1 are offered. Motors can be split phase, capacitor-start induction-run, capacitor-start capacitor-run, and polyphase. DOERR ELECTRIC CORP.

ON WATER CONDITIONING CONSULT AMERICAN ... first

advanced engineering is the important factor in

AMERICAN

water conditioning service



AMERICAN TRAY DEAERATORS DESIGNED FOR BEST POSSIBLE EFFICIENCY

American Tray Deaerators are made in all types and shapes for any possible working conditions. Over a half century of experience in successfully solving water treatment problems is in back of American Tray Deaerator design —and included are these outstanding American Features:

1. Deaerator compartments are separate units fabricated of stainless steel.
2. Only clean incoming steam and deaerated water are in contact with the pressure vessel shell.
3. Air separating trays have 50% more spillage edge and 100% more open passage than similar trays.
4. Counterflow operation gives greatest possible deaerating action by sweeping contaminating non-condensibles back to the vent condenser.

A successful deaerator installation depends upon the perfection of details. In American designs only those components are used which are leaders in their field and consideration is given to assure that all these accessories operate smoothly and "fail safe". Our engineers are ready to study your requirements. Write for Bulletin 402.

SERVICE SINCE 1902 — TO THE INDUSTRY

AMERICAN Water Softener COMPANY

INCORPORATED

FOURTH AND LEHIGH AVENUE • PHILADELPHIA 33, PENNSYLVANIA

DEAERATORS • HOT PROCESS SOFTENERS • REACTORS • FILTERS • ZEOLITE SOFTENERS • COLLOIDAL DECALCALIZERS • AERATORS & DEGASIFIERS

HYDROGEN SODIUM ZEOLITE SOFTENERS • DEMINERALIZERS • CHEMICAL FEEDERS • CONTINUOUS BLOWDOWN • SWIMMING POOL EQUIPMENT

Circle 145 on READ-N-CIRCLE card for more data

new bulletins

. . . just circle key numbers on READ-N-CIRCLE card on page 75

400-Do you cool or absorb gases?
Scrubbers for product recovery, gas purification, and elimination of atmospheric pollution are described in Bulletin 203-B. Principles of operation are explained with diagrams, and technical data are included. Six pages. PEABODY ENGINEERING CORPORATION.

401-How to preserve masonry
Kinds of masonry, effects of water absorption from without and vapor migration from within, and methods of caulking and pointing prior to application of preservatives are thoroughly explored in "Masonry Preservation." Well illustrated with diagrams and photographs, the book is divided into 10 sections. It is based on information obtained from both laboratory and field experience. Sixteen pages. THE TREMCO MANUFACTURING COMPANY.

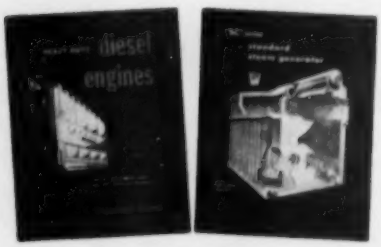
402-Fluid drive selection guide
New fluid drive for general purpose industrial adjustable speed applications is discussed in Bulletin 9419-9519. Advantages and applications are described, emphasizing such factors as speed control, power savings, no-load starting, torque limitation, acceleration control, shock absorption, and simplified installation. Tables indicate the proper fluid drive to use with drive motors rated from 7.5 to 800 hp. Eight pages. AMERICAN BLOWER CORPORATION.

403- What is a fan stack?
What a combined fan stack is, and what it does is described in Data Series 1-PDC along with details of construction of the stack and fan wheel. Twelve pages. THE THERMIX CORPORATION.

404-Stainless bar-stock steam trap
Thermodynamic steam trap that is machined from stainless steel bar stock and consists of only three parts — body, cap, and a solid stainless disc (the only moving part) — is discussed in Bulletin 255-44. Operates at top efficiency from 10 to 600 psi and on light or heavy loads. Operates against back pressures up to 50 percent of inlet pressure. Table of capacities is included. Two pages. SARCO COMPANY, INC.

405-Dehumidify compressed gases
Bulletin R-11 discusses moisture load calculations, water-cooled and refrigeration-cooled dehumidifiers, sorption dehumidifiers, applications, and nomenclature. Also mentions the effect of using moist air in several industrial applications. Twelve pages. DESOMATIC PRODUCTS.

406-Quick-coupling fluid filters
Construction and operation information on non-short-circuiting fluid filters and strainers is presented in Bulletin 45570. Mesh sizes are tabulated with sizes and ratings of multiplex units. Four pages. RONNINGEN MANUFACTURING CO.



407-Heavy-duty diesel engines
Information on the lubrication, cooling, and fuel injection systems of Type S and SS heavy duty diesel engines is presented in Bulletin 10,040. It includes details about engine housing design, full floating aluminum bearings, large diameter crankshaft, gear-driven auxiliaries, specifications, and engineering data. Illustrations of the engine and component parts are included. INGERSOLL-RAND.

408-Standardized steam generators
Pre-engineered, standardized steam generators in nine sizes, with capacities from 50,000 to 150,000 pounds per hour, are described in Bulletin B-55-4. Standardized generators assure minimum initial and operating costs with promptest delivery schedules. Schematic and cutaway drawings of the units and design features are included. Four pages. FOSTER-WHEELER CORPORATION.

409-Electric heating for heavy fuel oil
Typical electric oil heating systems are explained with the aid of diagrams in Bulletin 1644-B. Heater selection chart, wattage correction charts, and rating table are included with wiring diagrams and a description of stub heaters. Eight pages. PREFERRED UTILITIES MANUFACTURING CORPORATION.

410-Modern monitor for temperatures
Low-cost protection for small or large installations is discussed, and features of the Omniguard system are described in Bulletin 3036A. A section on component and accessory selection for all applications is included. Eight pages. THOMAS A. EDISON, INCORPORATED.

411-Corrosion-resistant valves
Corrosion-resistant properties of Monel and nickel with specific applications for each are offered in Bulletin 9. Also gives casting composition of both alloys, describes their mechanical properties, and includes cross-sectional illustrations of gate, globe, and lift- and swing-type check valves. Four pages. ALLOY STEEL PRODUCTS COMPANY, INC.

412-Porous-stone air filters
Fool-proof, wear-proof Poro-stone air filters give added protection when installed just prior to pneumatic tools. Principle of operation is explained with the aid of cut-away drawings in Bulletin 117. Also included is a selection chart that tabulates pipe size, capacity, filter area, shipping weights, and prices. Eight pages. R. P. ADAMS COMPANY, INC.

413-Need a speed changer?
Operating advantages of "Vari-Pitch" speed changers are described in Bulletin 20B6013D. Available in twelve sizes from 1 to 75 hp with output speeds ranging up to 2900 rpm. Speed changers operate in either vertical or horizontal position. Suitable for reversing service with addition of a simple, low-cost tension stabilizer. Includes arrangement diagrams, selection and speed range tables. ALLIS-CHALMERS MANUFACTURING COMPANY.

414-Operation rehabilitation
Scientific methods of machinery inspection and new methods of industrial and marine equipment repairs are ex-

plained in Bulletin 55. A coordinated service of inspection, analysis of equipment failure, and restoration is discussed. MAINTENANCE ENGINEERING CORPORATION.

415-Packaged chemical feed systems

Packaged chemical feed units, for proportioning either one or two different chemicals into the flow system, are described in Bulletin LP-1254. The complete units comprise single or divided tanks from 25- to 200-gallon capacity. Equipped with simplex or duplex pumps for accurate proportioning of from a few cc to 18.6 gph. Come ready for connection to regular feed piping and electrical circuits. Special manual or automatic controls are available. PHILADELPHIA PUMP AND MACHINERY CO.

416-Water equipment policies

Best policies to follow in keeping water-using equipment clean are discussed in Bulletin 254. Trouble spots that can cause failures and enforced shutdowns in water-using apparatus are mentioned with solutions to the problems. Six pages. HALL LABORATORIES, INC.

FREE COPIES

For free copies of these handbooks, bulletins, and catalogs just circle the key numbers on the READ-N-CIRCLE card on page 75.

417-How to survey your steam needs

Formulas behind all package steam generators and illustrations of how a package steam generator installation can raise steam capacity without extensive structural changes are presented in Booklet "Sales Steam-2-1." An example shows how to make a professional survey of your own steam requirements. Complete records and two installation case histories are included. Twelve pages. CYCLOTHERM DIVISION NATIONAL-U. S. RADIATOR CORPORATION.

418-Water gages have more visibility

New high-pressure water gages with more inches of visibility within centers and no blind spots between sections are described in Bulletin 245A. Full description, including illustrations of various assemblies, appears with a table of specifications. Modification data are included with a figuring method for correct inclined gage centers. Two pages. JERGUSON GAGE & VALVE COMPANY.

419-Electronic variable-speed drive

It is now possible to obtain the advantages of electronic adjustable-speed drive at a low price, through industrial adaptation of the printed control circuit. General-purpose, full-wave, Thy-motrol adjustable speed drive is described in Bulletin GEA-6234. Simplicity of op-

in SCOTCH MARINE
POWER BOILERS

Write for your copy of our Scotch Marine Power Boiler Bulletin B-3075A

The net to you is—A BETTER BOILER BUY! Our Scotch Marine pioneering over the years created the Titusville improvements that deliver outstanding performance for your application. Our largest-volume manufacture and sales bring you maximum dollar value in the boiler size and rating meeting your need. Let us give you the facts that tell the Titusville story!

A division of Struthers Wells

THE TITUSVILLE IRON WORKS COMPANY
TITUSVILLE, PA.
Manufacturers of A Complete Line of Boilers for Every Heating and Power Requirement

Circle 104 on READ-N-CIRCLE card for more data

new bulletins

. . . starts on page 22

eration and economy are explained with construction details and typical industrial applications. Eight pages. GENERAL ELECTRIC COMPANY.

420-Oil seal manual

Quick reference manual covers selection, application, and installation of clipper oil seals. Descriptions cover the latest seal designs, including extruded and molded oil slingers and end face seals. Essential data is in tabular form. Important points are well illustrated. Twenty-eight pages. JOHNS-MANVILLE.

421-Feeders and rotary valves

Roll and vane-type feeders and rotary valves that handle a large variety of dry pulverized and granular materials are described in Bulletin F-5. Includes descriptions of feeders built of cast iron or iron and steel combinations. Photographs and drawings illustrate the different types of feeders. Key dimensions and capacities are tabulated. Eight pages. FULLER CO.

422-Family-album compressor catalog

A family album showing all the compressors and centrifugal pumps manufactured by the company is presented in Bulletin 603. Thumbnail sketches and brief descriptions of each type with sources of further information are included. Six pages. PENNSYLVANIA PUMP AND COMPRESSOR COMPANY.

423-One-piece grating and treads

Load characteristics, types, and sizes of a complete line of electroforged steel and interlocked aluminum grating are described in Bulletin 2486. The high strength, easy maintenance, open area, and provision of safe footing are discussed. A table of safe loads is included. Sixteen pages. BLAW-KNOX COMPANY.

424-Data on regenerative turbines

Cross-section diagrams illustrate operating principles of two-stage regenerative turbine pumps rated for hot and cold water. Bulletin 107 also contains photographs, data on mechanical seals, installation dimensions, construction details, and performance tables. Twelve pages. ROY E. ROTH COMPANY.

425-No more lubrication guesswork

Dependable centralized lubrication helps maintain peak production and reduces operating costs. Bulletin 26 gives detailed diagrams and photographs to illustrate how the units work. Catalog section of fittings and accessories is included. Twenty pages. THE FARVAL CORPORATION.

426-Stainless-steel atomizing deaerator

Complete description of the special features incorporated in this latest jet atomizing deaerator development is offered in Bulletin 102. Operational advantages to be gained from corrosion-resistant equipment of this type are enumerated. Counter-current two-stage deaeration, positive steam scrubbing action, and springless self-adjustment at all loads are discussed. Four pages. L • A WATER SOFTENER COMPANY.

427-Flexible curtain dampers

Dampers for ducts handling flue gas, air, or gas provide tight closure and accurate control of flow — either automatically or manually. Data Series 1-HEA describe dependable, accurate control over a complete load range. Twelve pages. THE THERMIX CORPORATION.

428-Electrodes for all position welding

New line of low-alloy steel arc welding electrodes for the welding of chromium molybdenum alloy steels of the lime-ferritic, AWS xx15 type, are excellent for all-position welding when using direct current, reverse polarity. Bulletin 55CM describes electrodes that almost completely eliminate weld cracking. Preheat temperatures can be decreased to reasonable levels. Stress-relieving on many applications can be eliminated. Available in 3/32 through 3/16-inch diameters in four grades. THE CHAMPION RIVET COMPANY.

429-Selection tips for regulating valves

Automatic regulating valves, float valves, back-pressure valves, reducing valves, and tank thermostats are described with selection tips and complete engineering data in tabular form in Catalog 54. Sixty-eight pages. KLIPPEL VALVES, INC.

430-Deaerating heater offers economy

Deaerating heater for use in small steam-generating plants offers economy of operation, low initial cost and needs minimum space requirements. Bulletin WC-118 describes design, operation, and application of the heater. Photographs and cross-sectional diagrams included with table of capacities. Four pages. GRAVER WATER CONDITIONING CO.

431-High-voltage motor control

High-voltage starters with current-limiting Limitamp fuses offer coordinated control of squirrel-cage, synchronous, wound-rotor, and multi-speed motors. Bulletin GEA-6331 shows simplified installation, and reduced space requirements. Twelve pages. GENERAL ELECTRIC COMPANY.

432-Roof Ventilators move 10% more

Dimensions, specifications, and performance data on a complete line of roof ventilators that eliminate back flow of air and increase air delivery by 10 percent are available in Catalog A-112. Includes information and photographs of an efficient low-price roof ventilator and stack cap for simple, economical duct exhaust systems. THE HARTZELL PROPELLER FAN COMPANY.

433-New heat transfer medium

Non-metallic plastic compound with high heat-transfer properties that is applied in viscous paste form over conventional steam-traced, or thermal-electric systems is discussed in this bulletin. When properly cured, the compound bonds itself to equipment and coils to form an unbroken thermal connection with maximum surface contact. Particularly suitable for instruments, glass equipment, complicated pumps, valves, and pipelines. Six pages. THERMON MANUFACTURING COMPANY.

434-Top-running overhead cranes

Information on top-running double girder cranes with top-running trolley and under-running trolley in capacities from 2 to 12 tons and with spans up to 60 feet is offered with illustrative data in Bulletin T202. Data is also included on top-running single girder cranes, both motor-driven bridge types and hand geared or push types in capacities

from 1 to 10 tons and with spans up to 50 feet. Dimension sheets are included. CHICAGO TRAMRAIL CORPORATION.

435-Portable air compressor

Electric-driven 125-hp air-cooled two-stage stationary air compressor that can be easily moved from job to job is described in Bulletin 3188. Features include: single-core, horizontal-flow intercooler, new shrouding, force-feed lubrication, full free-air unloading, and a new channel valve. Either constant-speed control or dual control with automatic or manual selection can be supplied. Four pages. INGERSOLL-RAND.

436-Modern tube expanders

The latest tube-expanding equipment available for fire-tube boilers, water-tube boilers, condensers, and similar heat transfer units is explained with the aid of drawings in news bulletin. Reference is made to bulletins with specifications and technical data. Typical boiler and condenser units are illustrated for which the expanders are recommended. Four pages. THE GUSTAV WIEDEKE COMPANY.

437-Special manual for grating

All information and data vital to the plant engineer are given in this manual that covers all types of grating, open steel floor armor, stair treads, vessel liners, bridge decking, and drain grates. It includes safe-load tables, panel width constant charts, tables on standard widths and types of steel stair treads, and types of grating anchors. Booklet makes a handy reference tool. Sixteen pages. KLEMP METAL GRATING CORPORATION.

438-New gear manual is a must

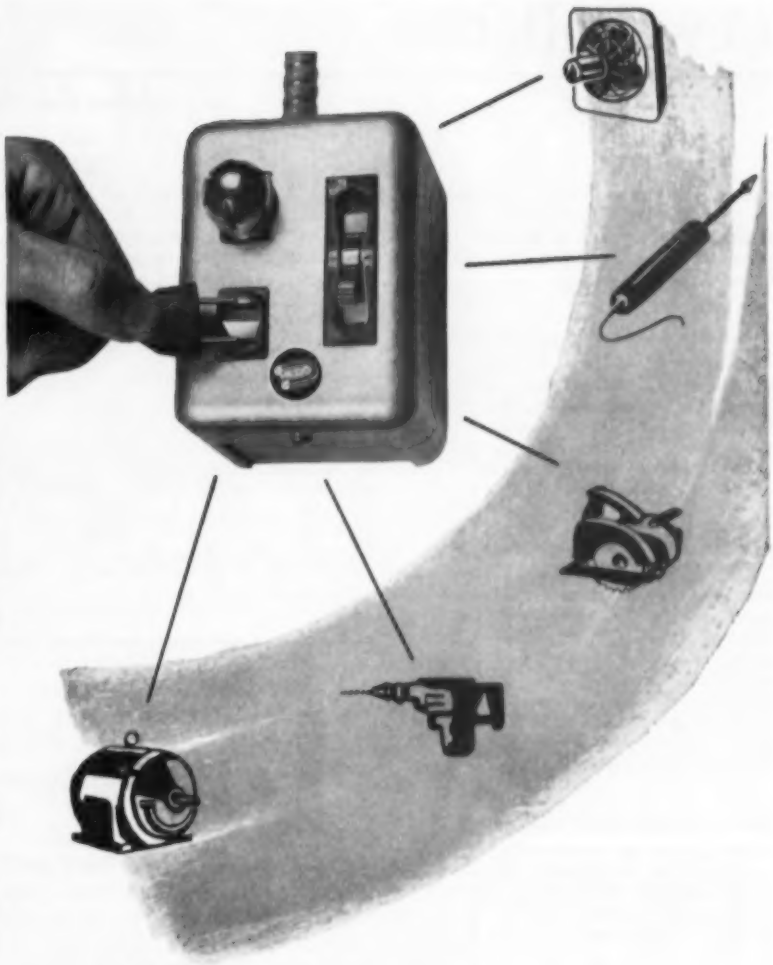
Illustrations, diagrams, definitions, tables, charts, and explanations regarding all types of gears are offered in Manual G655. For the first time, a simplified method of calculating horsepower ratings of all types of gearing is presented. This free manual is a must for all plant engineers. Seventy-six pages. PHILADELPHIA GEAR WORKS.

FREE COPIES

For free copies of these handbooks, bulletins, and catalogs just circle the key numbers on the READ-N-CIRCLE card on page 75.

439-Industrial heating handbook

New handbook provides plant engineers with basic concepts of industrial heat processing and heat control. Pruned of technical language, the handbook goes from a discussion of heat-to-fuel cost comparisons to design elements. Common formulas used in calculating heat



SAFELETS are *safe outlets* . . .
for on-the-spot overload protection

Wherever electrical appliances or power tools are used . . . wherever the danger of overloading exists . . . there's need for a *Safelet*.

A unique individual protection station, the *Safelet* is another practical application of the Heinemann Circuit Breaker. It interrupts short circuits or large overloads instantly, yet allows normal inrush or harmless overloads. The circuit breaker is combined with a convenience outlet in an attractively styled metal wall-box.

Safelets protect either the branch circuit wiring or equipment plugged into the line. They are available in ratings up to 15 amperes, and, for protection of fractional horsepower motors, in ratings up to 1 hp. An optional feature is a pilot light which shows when the circuit is in use. Several types of female receptacles are available.

Safelets are safe outlets for power tools, soldering irons, exhaust fans, oil burners, air conditioners and miscellaneous small appliances. Installed in your plant, they can save many hours of down time, many dollars in equipment repair and replacement costs.

For details, write for Bulletin 1010.

HEINEMANN ELECTRIC COMPANY
140 Plum Street • Trenton 2, New Jersey

HEINEMANN Circuit breakers

Circle 113 on READ-N-CIRCLE card for more data

new bulletins

. . . starts on page 22

and oven requirements are included. Bulletin 555 is a refresher course in process heating, and is a must for all plant engineers. Twenty pages. MICHIGAN OVEN COMPANY.

440-Electronic control system principles

Components of the Autronic control system, and all-electronic system for power instrumentation is described in Bulletin A1.3-1. A brief description of the function and working principles of each unit is presented with illustrations. Four pages. THE SWARTWOUT COMPANY.

441-Better drawing reproduction

How to improve engineering drawing reproduction is told in Bulletin F7-103. Auto-positive paper protects original drawings, reclaims old drawings, improves legibility of prints, reproduces unprintable originals, speeds revision of drawings, combines standard designs, simplifies print distribution, and widens print services. Eight pages and folio. EASTMAN KODAK COMPANY.

442-Liquid level gage illuminators

Newly improved solid-wedge type illuminators are illustrated and described in Bulletin 203. The U/L approved explosion-proof lighting unit is also described and pictured, with specifications and list of models available. JERGUSON GAGE & VALVE COMPANY.

443-Packaged heavy-duty compressors

Heavy-duty compressors that are ready to run when received, save installation time and expense, and require smaller foundations and floor space are described in Bulletin L-676-B1. The savings to be made in installation costs and in operation and maintenance costs are discussed. Salient features are described with the aid of four-color drawings and photographs. Thirty-two pages. WORTHINGTON CORPORATION.

444-Stainless condenser tubing

Two typical specifications, ASTM A-249 and A-269, covering tubing for heat exchangers and condensers have been broken down, paragraph by paragraph, to show how Electrunite tubing is processed to meet each requirement. Photographs illustrate the description of production operations and a size and gage chart is included in Bulletin HES-1. Twelve pages. REPUBLIC STEEL CORP.

445-Rid your liquids of iron

Protection against fine iron and tramp iron contamination of liquids by use of permanent magnetic traps is discussed in Bulletin B-605. Available in standard and highly polished sanitary models, the unit can be opened for cleaning and be back in service again within seconds. Capacities are tabulated alongside suggested installations. Four pages. ERIEZ MANUFACTURING COMPANY.

FREE COPIES

For free copies of these handbooks, bulletins, and catalogs just circle the key numbers on the READ-N-CIRCLE card on page 75.

446-Efficient dust collector

Collector with high collecting efficiency, constant pressure drop, long life, and easy maintenance is discussed in Data Series 1-ATC. What the unit is and what it does are described with construction details, dimensions, case histories, and capacities. THE THERMIX CORPORATION.

447-Tips for materials handling valves

An explanation of the control techniques that can be used with air-electric, remote, or manually operated valves is presented along with important factors to be considered when designing a collecting hopper for proper material flow to a valve in Data Sheet DVa. ALLEN-SHERMAN-HOFF CO.

448-Straight wash pressure filters

Advantages of this type of filter are discussed with the aid of photographs and diagrams in Bulletin 720. Also included is a table of sizes, capacities, weights and connection sizes. Four pages. AMERICAN WATER SOFTENER COMPANY.

449-All-purpose rubber packing

Specification chart comparing the qualities of six types of natural and synthetic rubber is supplemented by an information check-form for readers desiring assistance on special problems. Bulletin H-20 also lists the types of all-purpose pure gum and synthetic rubber sheet packing and the recommended uses for each. A chart shows the physical properties of each. Eight pages. HEWITT-ROBINS INC.

450-Heavy-duty package compressors

Double-acting stationary compressors in package units that are compact, easily installed, economical, and flexible are described in Bulletin 766-5. Diagrams and photographs explain these units with capacities from 400 to 1650 cfm at 80 to 125 psi. Twenty pages. CHICAGO PNEUMATIC TOOL COMPANY.

451-Refractory has twice normal life

New high-temperature Crystalite refractory has superior qualities up to 3326 F, high resistance to thermal spalling, structural spalling, and deformation at high temperatures. Photographs illustrate bricks, special shapes and spalling comparison tests. Tables list physical and chemical properties. Bulletin CR-11 also contains a thermal conductivity chart and list of applications. Twelve pages. RICHARD C. REMMEY SON CO.

452-Automation through speed control

Colored cross-sections and diaphanous views show how pneumatic control has been designed into U. S. Varidrive motors to increase and improve production output. Bulletin 1882 shows typical automatic control applications. Eight pages. U. S. ELECTRICAL MOTORS, INC.

453-Metal Protection gets color

Color paints not only protect expensive installations with a single coat but also help to improve morale. Now available in fifteen colors, the 520 series assure maximum rust-inhibition, flexibility, as well as resistance to normal weather, moisture and industrial fumes. SUBOX INC.

454-Complete specs on gas unit heaters

Propeller fan, and centrifugal blower powered units in eight sizes 25,000 to 200,000 Btu and new twin-fan 250,000 Btu suspended gas unit heaters are described in Bulletin B-55-US. Complete specifications, dimensions, and construction details of the heaters, for use with any type of gas are included. Four pages. REZNOR MANUFACTURING COMPANY.

ADJUSTABLE SPEED EDDY-CURRENT DRIVES, COUPLINGS, BRAKES, DYNAMOMETERS

The Modern Method of Adjustable Speed Control and Testing for a Wide Range of Industries

Dynamatic Eddy-Current Couplings, Brakes, Dynamometers, and Ajusto-Spede® Drives are in use today in practically every industry—both in plant equipment and end products. They offer the advantage of rapid response, wide speed range, quiet operation, low power loss, low maintenance cost, and infinitely adjustable speed control from an AC power source.

Send for our new Bulletin GB2, describing and illustrating the basic Dynamatic Eddy-Current units.

EATON

DYNAMATIC DIVISION
MANUFACTURING COMPANY
3307 FOURTEENTH AVENUE • KENOSHA, WISCONSIN

PRODUCTS: Sodium Cooled, Poppet, and Free Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater-Defroster Units • Snap Rings Springtites • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers

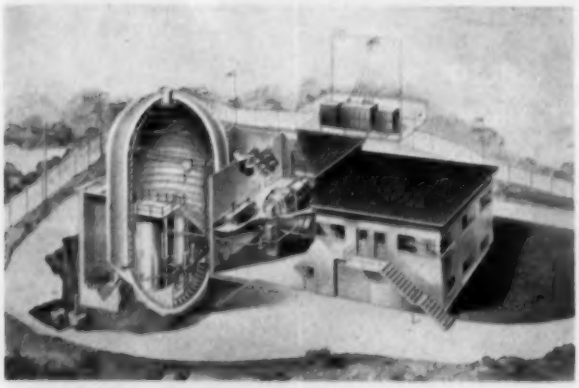
Circle 134 on READ-N-CIRCLE card for more data

ideas in action

. . . starts on page 28

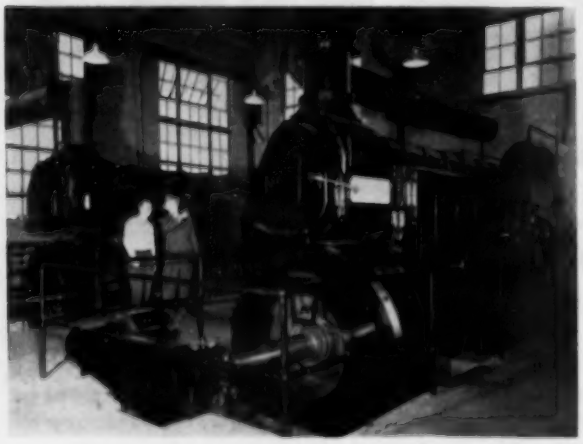
First package atomic power reactor

Construction is expected to start in September on the first package atomic power reactor plant. Alco Products, Inc. has selected Stone & Webster Engineering Corporation as engineer-constructor for the project. Component parts will be transportable by air anywhere in the world. The first unit will be constructed at the Army's Engineering Research & Development Laboratory at Fort Belvoir, Va. The reactor and steam generator will be housed in a vaportight steel container, 36 feet in diameter by 64 feet high, to prevent escape of fission products. The generated steam will be used in a 2000-kw turbine-generator. The development holds promise for many remote power generation requirements.



Dual fuel cuts Diesel costs 31 percent

As soon as natural gas became available, the municipal powerplant at Paris, Ky. converted 93 percent of its total production to dual fuel. As a result, operating costs have been cut by more than 31 percent, from 12.4 mills per kwh to 8.5 mills. Fuel costs have been cut from 9.7 mills per kwh to 5.7 mills. This is an average reduction of more than 41 percent. Chiefly responsible for these savings are three Fairbanks-Morse dual-fuel engines. Two of the engines are 12-cylinder, 1920-hp, opposed-piston units, driving 1360-kw alternators. The third engine was installed as a conventional diesel engine in 1947 and converted to dual fuel in 1953. It is a seven cylinder unit driving a 980-kw alternator.



It is interesting that as a result of increasing economy, it actually cost over $25,000 less to generate 10,010,470 kwh last year than it did to generate 9,017,575 kwh in 1952.

During freezing weather, when the supply of natural gas is cut off, the dual-fuel engines are run on oil. Each engine is equipped with automatic safety devices that switch it over to oil operation should gas pressure fail during operation.

Home-made chemical feeding installation

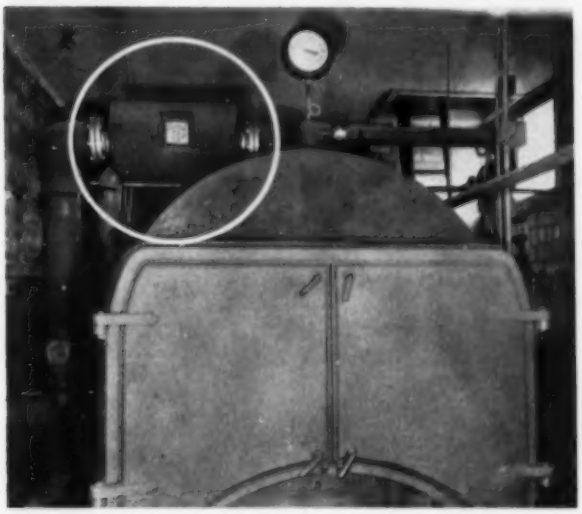
A home-made installation for feeding corrosion inhibitor to a large heating boiler system is doing a professional job at the U. S. Bureau of Mines Explosives Research Laboratory, near Pittsburgh. Film-forming amine Hagafilm, a product of Hagan Corp., is mixed every 24 hours into a 50-gallon steel tank that contains 218 F boiler feedwater. Mixing rate is 2 ounces per 100,000 pounds of steam generated.

The tank is insulated to keep the solution warm, and has a removable top. A ½-hp motor turns a stainless steel stirrer within the tank. Marks on the gage glass fixed to the side of the tank denote four even draw-outs of solu-

tion within the 24-hour period. An eductor feeds the inhibitor into the suction of the boiler feedwater pump. The operator reports that the treatment has successfully reduced failures and maintenance, particularly of traps and steel return lines.

Boiler priming shutdowns eliminated

Considerable priming troubles have always been experienced after a heating system is started up, due to the accumulation of foreign matter (cutting oil, pipe dope, dirt, and other material) in the system during the original installation. This foreign matter is carried to the boiler with the condensate returns. It induces priming which discharges large quantities of water into the steam system, recirculates the objectionable foreign matter, wastes fuel, and causes excessive fluctuation in water level with too



frequent cycling. Boiler shutdowns caused by boiler priming have been eliminated with a Hi-eF line-type purifier, manufactured by V. D. Anderson Company, used as a header in their low-pressure boiler installations around the Salt Lake City area. The purifier intercepts virtually all the water and entrainment leaving the boiler, and keeps it out of the heating system. Protection is foolproof and automatic since it requires no attention from the operator. Troubles caused by priming have been eliminated because the water and entrainment are returned directly to the boiler and debris is removed with periodic blowdowns.

TV eye watches all the time

TV eye closed-circuit television system is speeding and improving production by constantly watching a process at the New Jersey plant of Peter J. Schweitzer, Inc. producers of cigarette paper. It is being employed for remote observation of a paper pulp washing tank.

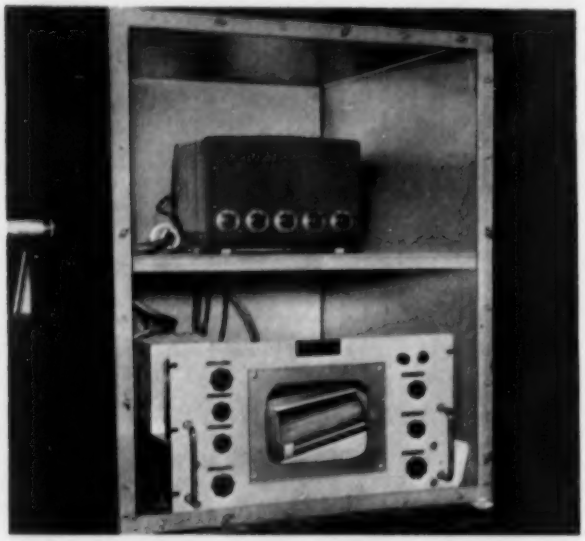
Before the installation was made, the operator was required to make periodic trips from the main production floor to the pulp-washing room to check the operation of the washing tank. The tank has a large revolving drum which tumbles the pulp mass. Should the pulp pile up and plug the drum, the entire tank must be emptied and cleaned before operations can be resumed. The continuous, remote observation provided by the closed-circuit system warns the operator of impending trouble in suffi-

Exclusive Ranney screened laterals collect huge volumes of naturally filtered water
The Ranney Method Assures a Pure, Sanitary Water Supply
Natural Filtration
The RANNEY METHOD, by Natural Filtration, produces water of better chemical quality than ground water . . . as proven by the many RANNEY installations now in operation. Each delivers millions of gallons per year of clear, non-turbid water at lowest cost. The RANNEY method reduces, or eliminates entirely, costly filter plants. If you need an efficient, economical water supply . .
RANNEY METHOD
Water Supplies Inc.
Water Supply Engineers and Contractors
841 Alton Columbus 19, Ohio
Dept. IP-3
Associate:
Ranney Method Western Corp.
Circle 149 on READ-N-CIRCLE card for more data

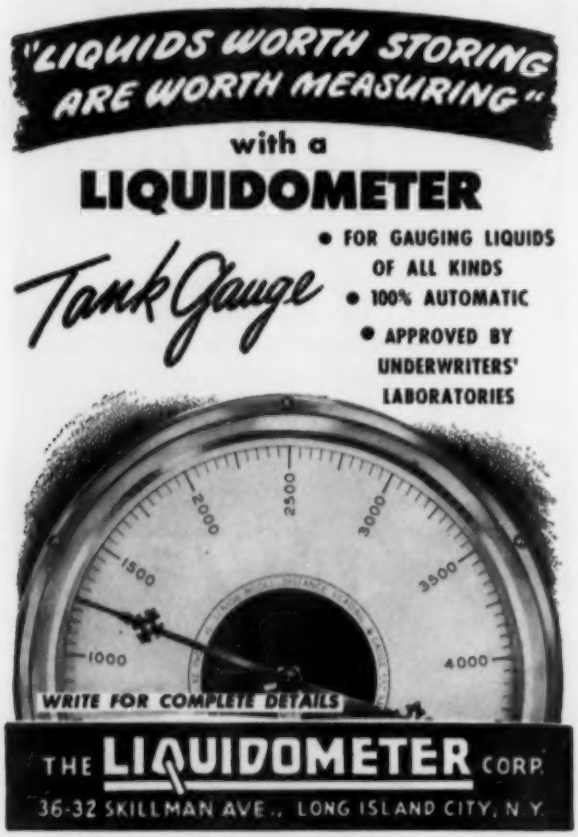
ideas in action

. . . starts on page 28

cient time to prevent jamming of the equipment. Both the camera and monitor are enclosed in pressurized transpar-



ent cases to assure maximum picture clarity, despite heavy moisture content in the atmosphere.



Circle 108 on READ-N-CIRCLE card for more data

Permanent magnets save 1000 pounds of plastic per week

Permanent non-electric magnetic separators supplied by Eriez Manufacturing Company are saving 1000 pounds of plastic material a week that formerly had to be reworked. The finished product, at American Cyanamid is free of any ferrous contamination because of the four magnetic grates installed over one end of the vibrating conveyors that carry the plastic to the packaging stations.

Before the magnets were installed, tiny pieces of ferrous material would get mixed in with the plastic granules despite thorough screening. The iron particles could eas-

ily damage customers' expensive molds besides defacing the final plastic product. As the plastic granules shake and bounce from the conveyors, any fine iron particles present are attracted by the magnet and securely held, allowing the pure plastic to pass into the finish drums.

Low-cost controls save $47,000 on water bills

How to save on process water costs when using 684 million gallons a year can be a big problem. Besides wanting to lower its water bill, the Detroit Edison Company wanted to support a local water conservation. A system for regulating the flow of cooling water into substation transformers was worked out with the assistance of experts from the Fulton Sylphon Division of Robertshaw-Fulton Controls Company.

Of course, the installation had to be low in cost and be almost maintenance-free. A test installation was set up using a Sylphon temperature regulator, 1½-inch valve size. As the water temperature in the transformer jacket rose, the regulators opened to admit a greater flow of cooling water. Conversely, the regulators slowed down the flow as the transformers cooled. Accurate records were kept. They showed that the company saved $300 in water costs during the six-month test period in return for the

(more ideas in action on page 66)

next month in
INDUSTRY & POWER . . . .

nuclear power for your powerhouse

How soon will nuclear reactors be ready for industrial powerhouses like yours? What obstacles will have to be conquered? What kind of operating techniques and system response can you expect? The answers to these and other vital questions on nuclear power for industrial plants will be answered for you in an interview story appearing exclusively in INDUSTRY & POWER.

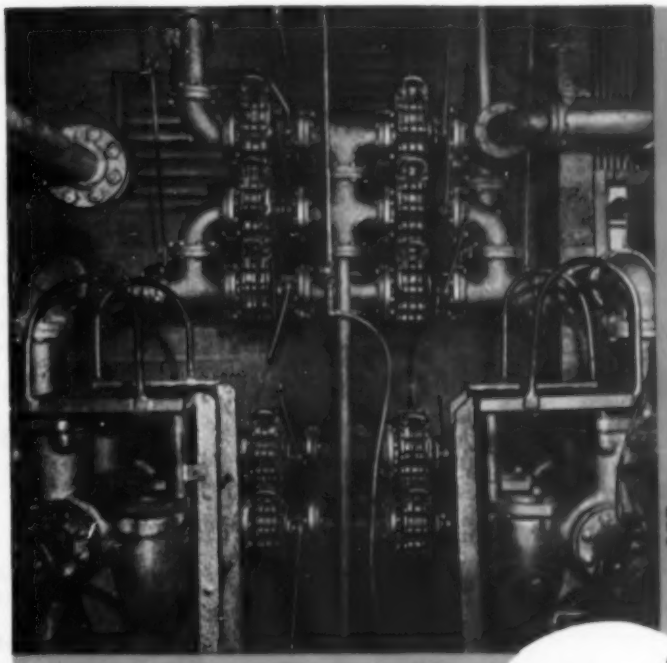
watch for the September issue of INDUSTRY & POWER

you can still get
copies of I&P's special report on

in-plant electrical distribution

New trends are constantly reshaping electrical practice in industrial plants. This comprehensive report distills the essence of the trends reported exclusively to INDUSTRY & POWER by the country's leading manufacturers, designers, and users of industrial electrical distribution systems.

To meet the continuing demand for this special report, INDUSTRY & POWER makes reprints available to all readers. Single copies are free; 2 to 25 copies are 25¢ each; 26 to 50 copies are 20¢ each; 51 to 100 copies are 15¢ each; more than 100 copies are 10¢ each. Write, on your company letterhead please, to Reader Service Dept., INDUSTRY & POWER, Commercial Bank Building, St. Joseph, Michigan.



EVERLASTING Steam Jacketed Valves on manifolds handling tar products.

Jacketed Valves

that keep
Viscous Materials
flowing freely

for

coal tar products, asphalt, pitch, resins, varnish, waxes, paraffin, molten sulfur, etc.

Note these features:

Extra-large jacket space
Straight-through flow
Drop-tight seal
Non-wedging discs
Quick-acting lever

Write for descriptive bulletin and our 60-day free trial offer.

For "everlasting" service, use

EVERLASTING Valves

EVERLASTING VALVE CO.
41 FISK STREET, JERSEY CITY 5, N.J.

EV 304

Circle 141 on READ-N-CIRCLE card for more data

Westmoreland Coal Company

HAMPTON COAL · CRITERION COAL

Stonega Coke and Coal Company

GLENBROOK · RODA · CROSSBROOK · STONEGA · DENDRON

Page Coal and Coke Company
Crozer Coal and Land Company

LYNCO · CROZER

PREMIUM ANTHRACITES
Products of Jeddo-Highland Coal Company
Hazle Brook—Raven Run

Genco Anthracites & Bituminous Coals

General Coal Company
123 SOUTH BROAD STREET . . . . . PHILADELPHIA 9, PA.
SUBSIDIARY SALES COMPANY—EASTERN COAL & COKE COMPANY
Cable Address: GENCO

Branches

BLUEFIELD, W. VA. · BUFFALO · CHARLOTTE, N. C.
CINCINNATI · CLEVELAND · IRWIN, PA.
NEW YORK · NORFOLK

Circle 119 on READ-N-CIRCLE card for more data

our readers write

. . . to industry & power

Tips on colloidal air system

Gentlemen:

In the February, 1955 issue of INDUSTRY & POWER there was an article on the Colloidal Air System for handling industrial wastes, written, I believe, by a man named Napier from Canada . . . . We would very much appreciate getting more detailed information from the makers of this equipment as we might find a possible use for it among paper mills, food processing industries, and a number of chemical plants. If you could give us the name of the company and the individual to contact we would appreciate it very much.

Richard Yates
Yates Equipment and Supply Company
Ripon, Wisconsin

● *Write to Richard V. Reeves, F. P. Walther, Jr. and Associates, Two Wavy Lane, Wantagh, New York.*

Better and better

Gentlemen:

I&P is getting better and better. We find information not found elsewhere.

M. G. Kopf
Technical Specialties Co.
Dayton, Ohio

Thermo refresher rolls on

Gentlemen:

As your magazine receives wide circulation in our plant and must reach many departments other than our own, I would appreciate, through this letter, being placed on your mailing list to receive for my own edification and leisurely perusal, each of the interesting and informative "Thermodynamic Refresher" articles.

H. Bracken Cox
United States Steel Homes, Inc.
Harrisburg, Pennsylvania

Gentlemen:

Please add my name to your mailing list for the "Thermodynamic Refresher." I would appreciate a complete set of the articles.

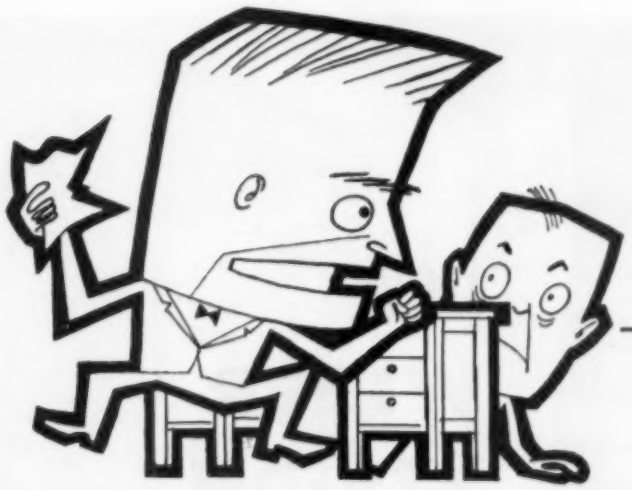
Herman L. Davis
Plant Engineer
Cabot Carbon Company
Pampa, Texas

Gentlemen:

I would greatly appreciate receiving the complete series of "Thermodynamics Refresher" articles that appear in INDUSTRY & POWER. Professor John Lee has done an excellent job of presenting this material and he should be commended.

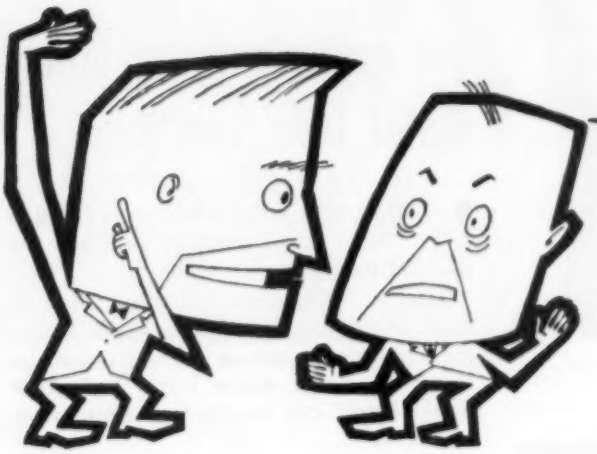
John A. Pruessner
Project Engineer
Sandusky Foundry & Machine Co.
Sandusky, Ohio

● *Requests, like those above, have been coming in from all parts of the country. Our Reader Service Department is filling all requests.*



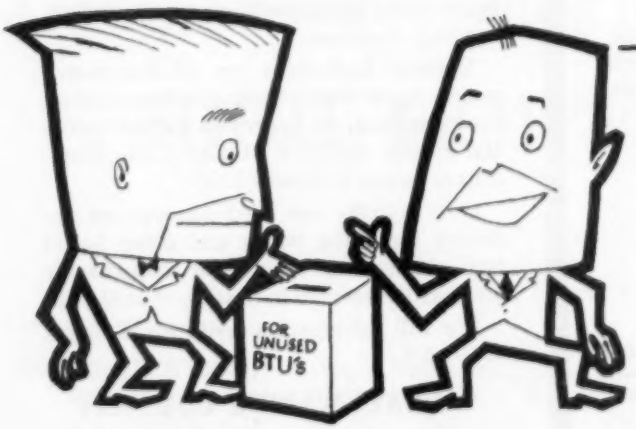
Fire the fireman! Here's another smoke summons.

Don't fire the fireman, he's doing his best. Let us look for a more adaptable coal.



What's wrong with the coal? It's high in BTU's.

Sure, it's a good coal—in the right furnace—but our set-up just can't supply enough air to burn all of the hydrocarbons before they cool off and blow up the chimney as free carbon.



There's no sense in buying BTU's we can't burn, is there?

You've got a point there—and one that so many people are never aware of. It isn't only what's in the coal that counts—it's what you can get out of it under your own set of conditions. That's why picking the right coal is a job for a competent combustion engineer. The superior quality coal produced at mines served by the Chesapeake and Ohio will meet our most exacting requirements. Before we sign another coal contract, let's get in touch with coal producers on the C&O or a C&O coal man to give us the facts and figures on which coal will cost us least in the long run.

P.S.

There's a lot more to buying coal than the cost per ton. For facts and figures to solve your particular fuel requirements, write to: R. C. Riedinger, General Coal Traffic Manager, Chesapeake & Ohio Railway Company, Terminal Tower, Cleveland 1, Ohio.

Chesapeake and Ohio Railway

WORLD'S LARGEST CARRIER OF BITUMINOUS COAL

Circle 117 on READ-N-CIRCLE card for more data

new WIDER VISION

for easier remote boiler water level readings

■ Vastly improved visibility of remote boiler water level readings can now be enjoyed by boiler plant operators.

A new "wide vision" face on Yarway Remote Liquid Level Indicators allows reading from the side as well as front of the indicator. Boiler water levels and other liquid levels can be checked from most any position.

Indicating mechanism is operated by the boiler water level itself—assuring instant, accurate readings.

Yarway Indicators are of the manometric type with automatic temperature compensation, as approved for use under the recent A.S.M.E. Boiler Code Committee ruling in Case # 1155.

Over 10,000 are used throughout industry for boiler water and other liquid level indication . . . and for superheater pressure differential indication aboard ship.

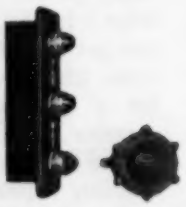
For full information write for Bulletin WG-1823.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

A COMPLETE YARWAY SYSTEM

Besides Remote Liquid Level Indicators, Yarway also offers Liquid Level Recorders and Remote Signal Alarms . . . making a complete system for constant, accurate liquid level check.

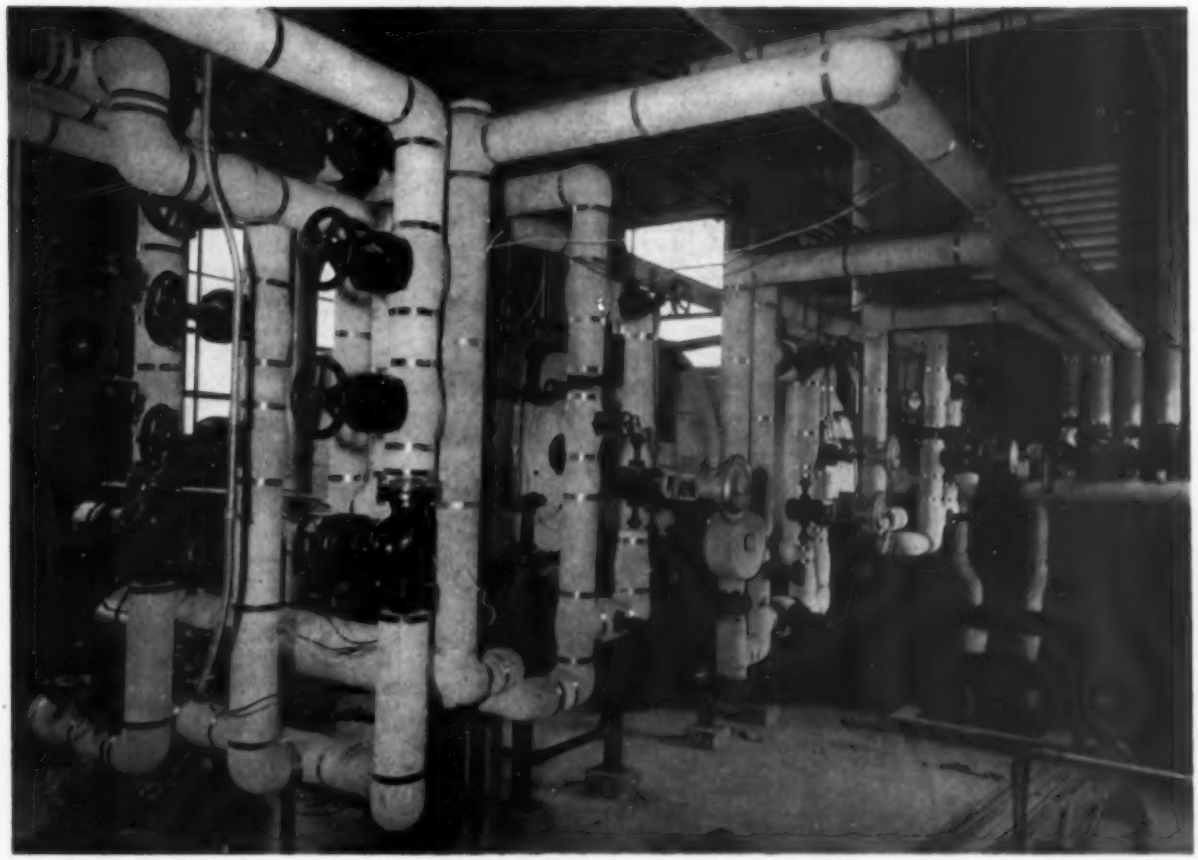
■ Yarway Hi-Lo-Graph Recorder provides not only water level indication, but also a 24-hour recording of water levels. See Yarway Bulletin WG-1830.



■ Yarway Remote Hi-Lo-Alarm Signals—lights or horns—can be placed at any location in plant. See Yarway Bulletin WG-1823.

YARWAY | ***remote liquid level indicators***

Circle 109 on READ-N-CIRCLE card for more data



Piping maze in one of 75 similar heat transfer stations. Heat, steam, and hot water generators are pneumatically controlled.

A lesson for multi-building plants . . . .

I&P EXCLUSIVE

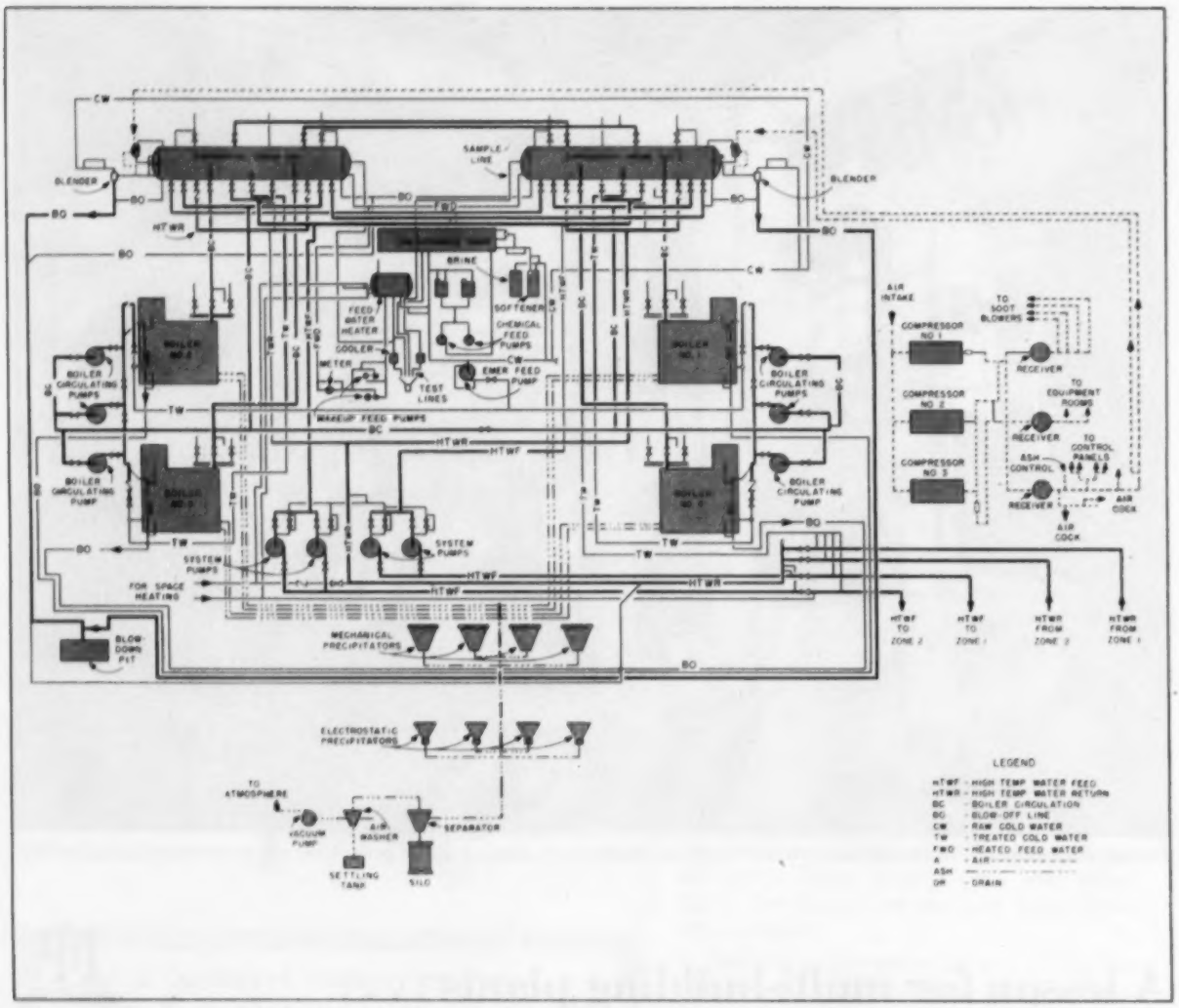
HIGH-TEMPERATURE water

ALEXANDER SAGE
Vice President and Chief Engineer,
Charles Simkin & Sons, Inc.

HIGH-TEMPERATURE water is the medium for space heating and other utilities at McGuire Air Force Base, New Jersey, in a system that well serves as a model for multi-building industrial plants. Pumping high-temperature water under great pressure to distant points of use is not new. It developed from experimental efforts in the early 1920's to circulate water of high temperature and pressure through a closed system. The mechanics of the method used at McGuire AFB, however, are new.

High-temperature hot water was chosen as the heating medium because it permits a larger amount of heat to be transmitted through the same size lines than is possible with conventional steam systems. It is a great deal more economical to install and operate such a system because a relatively large amount of heat is extracted from the water and no equipment is required for condensate removal. The water is usually circulated so that the leaving temperature from the boiler house is 400 F and the return temperature is about 280 F.

High-temperature hot water systems have an added advantage in that the plant does not have to be sized for big demands. Water can retain its heat for relatively long



Schematic flow diagram of central heating plant shows layout of principal equipment, high-temperature water and air lines.

periods and large volumes of water can be held in expansion tanks.

Ground was broken about 15 months ago for the boiler house to serve this $4,000,000, 6000-hp, high-temperature plant. Although the capacity of the installation is about 200,000,000 Btu per hour, it is presently serving about 100 buildings with a load of more than 62,000,000 Btu per hour. These buildings consist of barracks, dormitories, mess halls, utility rooms, and other miscellaneous buildings. They are all widely dispersed across the post. They are linked by 33 miles of heavily insulated underground piping which loses remarkably little heat in transmission and return.

Efficiency is kept comparatively high by using relatively small pipe sizes. In fact, insulation efficiency is so high that there is only ½ of 1 percent drop in initial temperature. Water velocity throughout the distribution system is sometimes as high as 12 feet per second.

How water is heated

The water is heated by four forced-circulation high-temperature radiant tube boilers. Each boiler can convert four tons of coal per hour into 50,000,000 Btu per hour. They are equipped with automatic spreader stokers and four forced-draft cooled traveling chain grates. The chain grates reduce ash buildup, assure stable firing and uniform ash removal, and prevent overheating even at the maximum ash disposal rate.

Bituminous coal was chosen as fuel for several reasons. Among these are relative economy of operation, and the feeling that bituminous coal will always be available in time of emergency when other fuels might be in short supply.

Six 40-hp motor-driven pumps circulate water at 1200 gpm to two expansion drums, each 8 feet in diameter and 40 feet deep. These drums act as accumulators for approximately 30,000 gallons of high-temperature water at 370 psi and 420 F. The expansion drums are an integral part of the boiler system. The four boilers are constructed without upper drums, but they are tied together with the two expansion drums so that the entire hookup makes one large boiler system.

The upper part of each drum serves as a steam cushion to maintain a constant pressure on the high temperature water system. The drums are tied together as a unit by balance lines for the water at the bottom and for the steam at the top. They are designed for 400 psi at 420 F. They are supported at three points. The center point is fixed and each end is on rollers to provide for expansion.

The expansion drums have four level control points with Magnetrol switching devices. At the highest point, the overflow system is actuated and an alarm contact is made. At the second point, the makeup feed pumps are deenergized. At the third point, the makeup feed pump is reenergized and at the fourth point the pumps distributing water to the system are shut off and an alarm is sounded. The bottom and top points are for emergency conditions only. Normal operating level is maintained between the second and third point.

Pneumatic valves mix water

The level in the feedwater heater is maintained in conjunction with the levels in the expansion drums. Pneumatic valves with overflow provisions are integrally linked to mixing controls that admit measured quantities of cool water into the overflow system to lower saturation levels and prevent flashing.

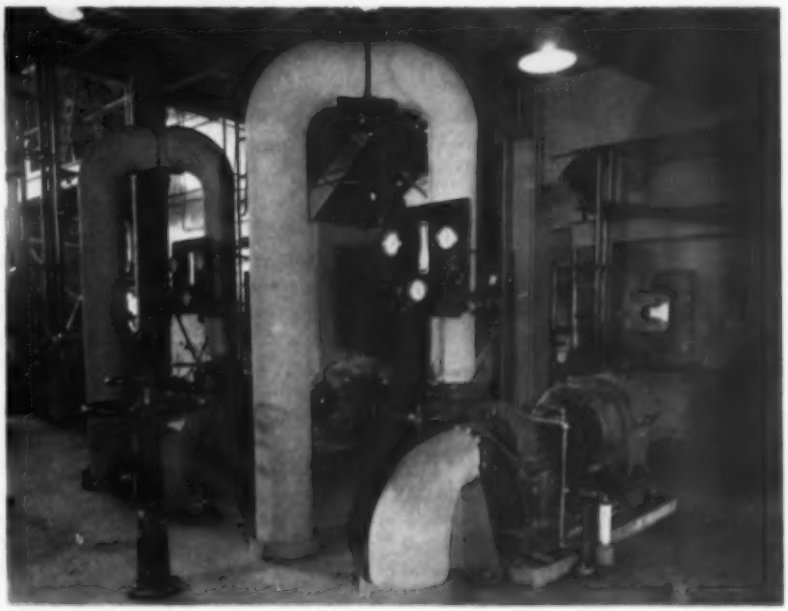
Boiler makeup is tapped from a drum 10 feet in diameter and 18 feet deep. City water used for emergency makeup passes through a Zeolite conditioner. It gets additional chemical treatment before storage in the 10,600 gallon cold water drum for subsequent passage through a 25,000-pounds-per-hour feedwater heater. The automatic softener equipment consists of two cylinders with automatic, multiway valves and built-in regeneration brine ejection. It has a softening capacity of 200 kilograms of calcium carbonate per cycle and maintains a flow capacity of 18 gpm.

High-temperature water heats the feedwater heater, donating enough thermal energy to raise the make-up temperature from 50 F to 210 F. This water discharges into the system together with the heat-exhausted liquid returning from its heating mission.

Graded coal delivered by freight car is stored in a 175-foot by 350-foot partially enclosed coal yard. Coal can be immediately shunted through an underground conveyor tunnel to a coal crusher. This reduces oversized pieces to 1¼ inches. Coal moves through seven different distribution chutes into a hopper above the boiler room. These chutes are opened and closed in such a manner as to maintain a relatively constant level of coal in the hopper. Should coal ever reach the capacity line of the hopper, an end switch arrangement automatically shuts off the flight conveyor. Tramp metal is removed by means of magnetic separators. The coal is weighed automatically. The stoker feeds are controlled by metering devices.

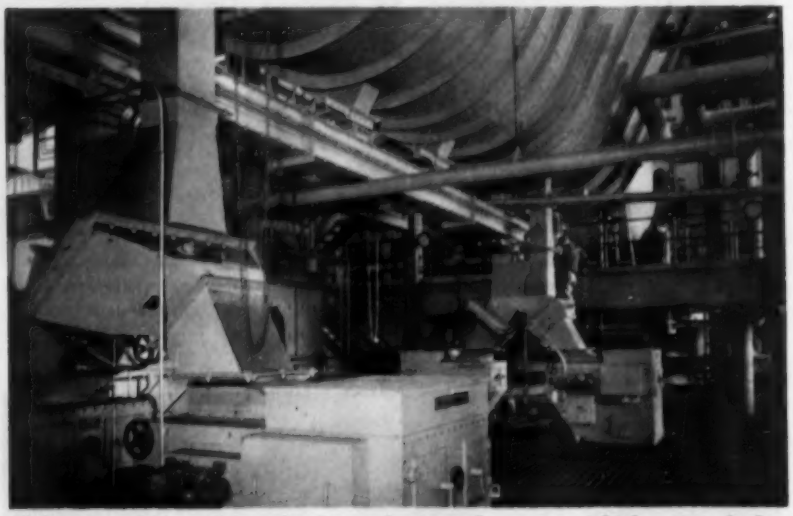
Each boiler has an independent draft system energized by four 18,300-cfm forced-draft fans in the

Three pumps controlled from main panel propel water returning from its heating mission through four high-temperature water radiant-wall boilers.



Two sets of zone circulating pumps move the outgoing high-temperature water. Handwheels control valves for blending cooler water into outgoing stream.

This control board indicates plant's overall activity. Tachographs and gauges indicate conditions in heat transfer stations, controlled from central plant.



Slide gates admit coal from bunker to horizontal conveyor which rations fuel to two automatic scales. Predetermined amounts then drop to automatic stokers.

basement and is supplied with overfire air. Ash clinkers drop from the traveling grate into a pit from which they are propelled pneumatically in abrasion-resistant piping to an outside silo. Fly ash is removed from flue gases as they pass through four multicyclone mechanical dust collectors operating at separation efficiencies of over 90 percent. Four electrostatic precipitators, with a volume capacity of 605 cubic feet each, clear the final effluent gases before they pass up the stacks at a rate of 28,000 cfm. A sensitive electric-eye haze gage registers smoke density in the base of the stack and actuates the controls for air and coal feed, draft zones, and operating differentials to readjust the system for most efficient smoke-free combustion.

The air stream conveying the heavier ash through the pneumatic ash handling system deposits them in a secondary ash separator. The air stream then passes through a steam exhauster and air washer where minute particles are removed. Thus, wasteful and objectionable exhaust gases are eliminated. Steam used in the washing stage is condensed and drained off into a disposal line to block the escape of any water spray into the atmosphere.

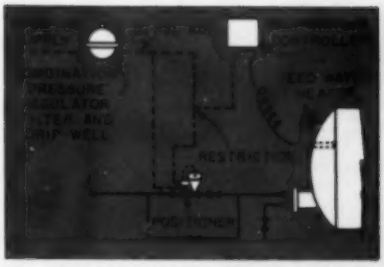
How system is controlled

A very complete control panel is nerve center of the complex system, recording on one instrument board every condition acting at any point at all times. A deficiency at any one stage of fuel movement, power generation, liquid or steam circulation, or waste removal will kick off the appropriate alarm. There are 30 different warning signals installed on the board. Discrepancies from normal operation are automatically compensated for and recorded. Complete manual control can also be exercised. On the control panel for each boiler are mounted:

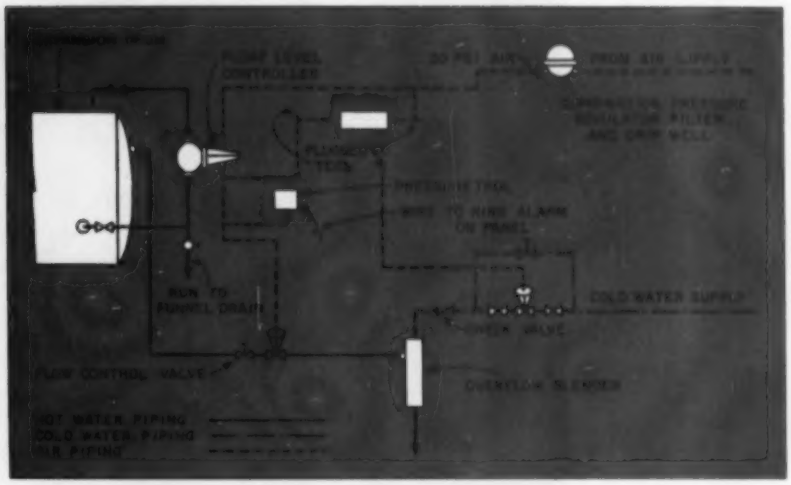
- Btu meter
- forced draft gage
- undergrate pressure gage
- furnace draft gage
- overfire draft gage
- dust collector draft gage
- precipitator draft gage
- CO_2 recorder
- temperature recorder
- smoke indicator
- fuel-air ratio controls

For each expansion drum there is a Yarway level control. For each circulating system there are water flow meters, compressed-air flow meters, Btu meters, temperature recorders, ammeters, and push button switches for all pumps.

Each pair of boilers is completely self-contained and can individually supply the two independent high-temperature water distribution zones that cover McGuire AFB. Water at 420 F is fed under high pressure into 10- and 12-inch conduits that branch arterially into a vast network of pipes to supply the dispersed building equipment rooms. There are three lines comprising the circuit—two equi-diameter outgoing and return high-temperature water lines and a three-inch pipe that supplies compressed air from the boiler house to air receiver tanks in the equipment rooms. This is for operation of air-actuated controls, including a series of pneumatic pressure regulators that activate the domestic heat converters, the hot-water generators, and the steam generators. These are all heated by the high-temperature



Drawing (above) shows system of temperature control for feedwater heater.



Drawing (right) shows hook-up of pneumatic overflow controls at the expansion drums. Drums are tied together at bottom and top with balance lines.

water. The domestic hot water leaves the convertors at about 160 F. Low-pressure steam is used for kitchen facilities and other related installations.

Although most of the buildings in the network extract their heat through a transfer station, several special purpose heating units utilize the high-temperature water directly, with a system of air heaters.

How pipe was laid

Advanced assembly line methods were used in the installation of 165,000 lineal feet of underground pipes. After excavating 11½ miles of trench to a predetermined depth and slope, a continuous 4-inch reinforced concrete base was laid along the trench floor. When the concrete hardened and tacked, cranes lifted lengths of pipe and seated them on small blocks spaced along the base.

Welders moved along the pipe lines, joining sections. Whenever they overtook the pouring or pipe laying teams, they were dispatched to other work on expansion bends and manholes. Pipes varying from 12-inch to 3-inch diameter were hydrostatically tested at 500 psi and then heavily insulated in a concrete-vermiculite envelope which was waterproofed to stringent government specifications.

A corrugated paper sheath was wrapped around the lines. Forms were spaced around the pipe to provide a 2-foot by 4-foot channel for a special poured concrete envelope. The forms were lined with two plies of tar paper and three intermittent coats of tar. Then a vemiculite concrete mix (normal density for straight lengths of pipe and a lean mix around expansion loops, z-bends and elbows) was poured. A final coating of a water-proofing membrane protects the concrete envelope. An additional four-inch-thick slab of concrete on three sides of the curved sections and a supporting eight-inch envelope wall at roadway and railway crossings put the finishing touches to the distribution network.

About 10,000 lineal feet of driven concrete piles support the 115 tons of structural steel framing for the 72-foot high boiler house.

The boiler house is enclosed in pink pastel concrete blocks interspersed with grey charcoal blocks. This smart installation with below-ground piping is a model of efficiency in keeping with today's trend in heating installations. The system is expected to have an indefinite life with an absolute minimum of maintenance and attention.

LIST OF PRINCIPAL EQUIPMENT

System design:	American Hydrotherm Corporation
Construction engineering:	Charles Simkin & Sons, Inc.
Boilers:	Combustion Engineering, Inc.
Grates:	Combustion Engineering, Inc.
Stokers:	Combustion Engineering, Inc.
Automatic coal scales:	Richardson Scale Company
Water circulation pumps:	Wilson Snyder Works
Forced draft fans:	Clarage Fan Company
Induced draft fans:	Prat-Daniel Corporation
Coal and ash handling:	Pettibone Mulliken Corporation
Dust separation:	Buell Engineering Company
Stacks:	Prat-Daniel Corporation
Control panel:	Hays Corporation
Pneumatic pressure regulators:	Johnson Service Company

Pump draws over 360 gpm from 76-foot well. Safety valve is set at 100 psi.

Take a second look at Where YOU get your WATER

ALBERT M. HALEY
Aircraft Division, Twin Coach Company

I&P EXCLUSIVE

A CRITICAL water shortage a few years ago forced the Twin Coach Company, Aircraft division, to literally wash its hands of municipal water supply. Today, they're saving over $1000 monthly on water bills, and have a comfortable steady pressure for any contingency. And their water tastes considerably better than the utility water.

Buffalo, like many metropolitan centers, began to feel growing pains during and following World War II. Residential expansion in the suburbs, with the exception of a few hastily-constructed projects, did not get underway in earnest until 1945. The water company's retail customers jumped from about 15,000 during the war years to about 30,000 by 1951. Although the water company has expanded its facilities, they are still insufficient to supply the present demands of about 35,000 suburban dwellings. During a recent dry spell, water was restricted for all customers.

Because of its proximity to the municipal airport and the availability of two huge, wartime hanger-type buildings, Twin Coach selected its present Aircraft division site just east of Buffalo, N.Y., in 1946. Water for the factory was furnished by the Western New York Water Company, an out-of-town managed utility that had survived the war years with limited facilities by pumping water to suburban communities from Lake Erie, some 12 to 15 miles away.

Tooled for building motor busses in 1946, and employing about 1500 workers, the new organization encountered no serious water problem at that time. Two years later, however, the company re-entered the aircraft production field. By 1950,

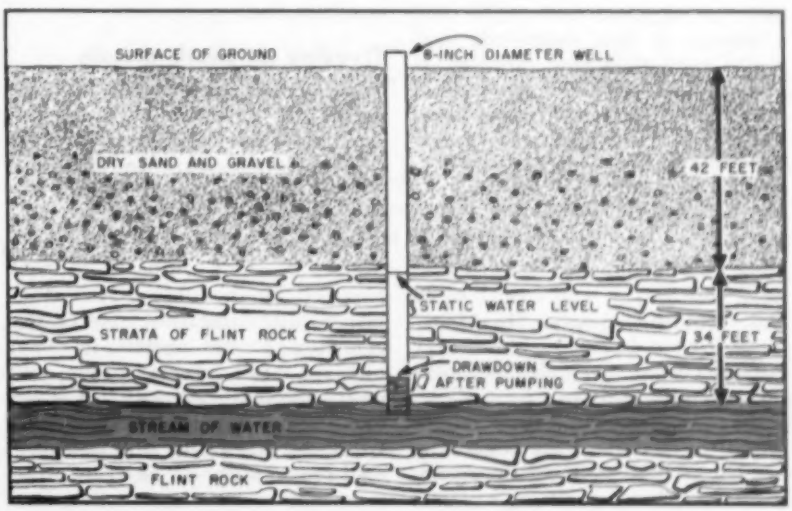
This 640,000-gallon concrete reservoir provides five hours supply in case of fire, is kept full by return line from plant cooling system and line off utility supply if needed. A 1½-in. steam line runs length of tank to avoid freezing up in winter.

its work force had doubled. New demands arose for water far in excess of the utility's capacity to supply them adequately. Water pressure during the summer months of 1951 dropped to a new all-time low of between two and three pounds—dangerously limiting the supply for process, sanitation, drinking, cafeteria uses, and the all important sprinkler and fire systems.

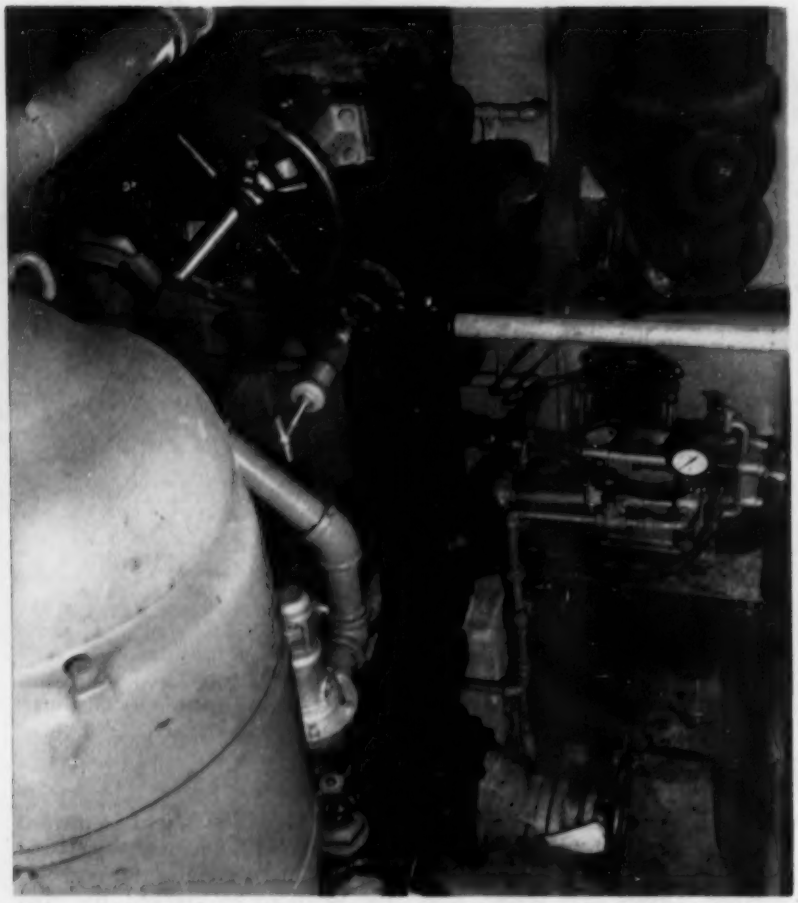
With all facilities consuming about 355 gallons per minute, it was apparent to everyone concerned that something had to be done quickly. The problem was handed over to John Anthony, at that time maintenance foreman and now plant engineer. Since very little was known about the local geology, Anthony decided that he might just as well look for water in a convenient location as anywhere else. Water was just as likely to be present in an accessible spot as beneath some such obstruction as the airport landing strip or the main production floor.

A local well-digging firm was engaged and the digger arrived with his locating apparatus, which consisted solely of a steel rod. Oldtimers generally favor the "willow-witch"—a forked branch of a willow tree held in both hands with stem pointing skyward. When the "diviner" passes over water, it is alleged, the stem will be drawn downwards. However, this diviner held the steel rod lightly at the point of balance and slowly traversed the prospective site until one end was drawn magnet-like toward the ground. Repeating the ritual from different angles to pinpoint the location, he marked the spot and set up his digging equipment.

Drilling through the first 42 feet of dry sand and gravel presented no problems, but the next 34 feet of flint rock went slower. Here, in



Geological sketch of well shows water levels in well and location of underground stream. Total cost of well was only $6538, yet saves $1000 monthly.



Meter on line to plant measures flow. Hypochlorinator on table feeds proportionate amount of chlorine solution into water from a 20-gallon tank.

a vein of flint rock, the drill struck a subterranean stream that produced a flow of 360 gpm — just over the required amount. Finding a stream of this magnitude was really more than was expected. It had been fully anticipated that eight individual wells might have to be drilled to obtain an adequate water supply.

Static level rises

Upon opening the rock with an eight-inch drill, the static water level rose in the well casing to 46 feet from the surface. This, however, drew down 21 feet after pumping began. A Fairbanks-Morse Pomona pump, driven by a 25-hp electric motor, was installed to pump the water up the remaining 67 feet of the well. An auxiliary gas-driven Rockford 30-hp unit with clutch was also installed with an automatic starter. The starter is energized by a 6-volt battery. However, it has not been necessary to use this auxiliary since the system was installed.

Treading the public domain

Because an operation of this type treads in the domain of public health and the franchise of a public utility, certain clearances and safeguards were necessary before the water could be used. An analysis of the water showed it to be preferable in some respects to that supplied by the utility. Nevertheless, health authorities insisted the company should install its own chlorination process. This was easily accomplished with a Wallace and Tiernan Hypochlorinator. This is a small pump that pumps a one-to-three mixture of chlorine solution and water from a 20-gallon tank into the plant feed line. The amount of mixture pumped into the line is determined by electrical data received from a flow meter on the line to the hypochlorinator distributor. The amount of mixture, pumped into the line thus varies, depending upon the amount of water being consumed by the plant. The 20-gallon tank is replenished every two days. The water is tested for chlorine content every hour by one of the employees. A consolidated report on daily chlorine content and amount of water consumed is sent to the county health department each month.

The well is not used exclusively. County water is utilized to maintain a 640,000-gallon reservoir for the plant fire department. Each morning for seven hours the system is switched to the county supply and the well pump is switched off. This is done for two reasons: to permit the well to build up and to save wear and tear on the pump.

Interconnects with utility

The system is interconnected with the county supply lines and is controlled by a versatile four-way, four-port, 90-degree-turn, two-position lubricated plug valve. In case of power failure, the valve can be switched at any time from one source of supply to the other. Check valves prevent the possibility of well water backing up into the utility's water main.

The dual system has worked without a hitch. Water bills that used to run between $1269 and $1460 monthly are now only $340 to $476. About 85¢ per day buys the two gallons of chlorine solution needed to maintain the specified chlorine content. The water pressure in the plant since digging the well averages 45 to 50 psi.

The well water, somewhat softer than the utility-supplied water, at first contained a vaguely sulfurous taste that has disappeared with continuous pumping. Its taste is now preferable to county water and its constant temperature of 55 degrees makes it ideal both for drinking and for cooling equipment such as the plant air compressors.

The total cost of the well including drilling, pump installation, and the building to house the equipment was $6538. All other advantages notwithstanding, the project paid for itself in six months.

Heart of the mechanical rectifier is the contact mechanism. Cams operating the switches are behind the glass at bottom.

Our first year with the MECHANICAL Rectifier

I&P EXCLUSIVE

Changing ac to dc? Here's what one big user of dc has to say about its first year with the latest model of the newest type of rectifier — the mechanical rectifier.

GEORGE DUCKWALL, Plant Engineer
Hooker Electrochemical Company
(as told to Harold A. Bergen, editor)

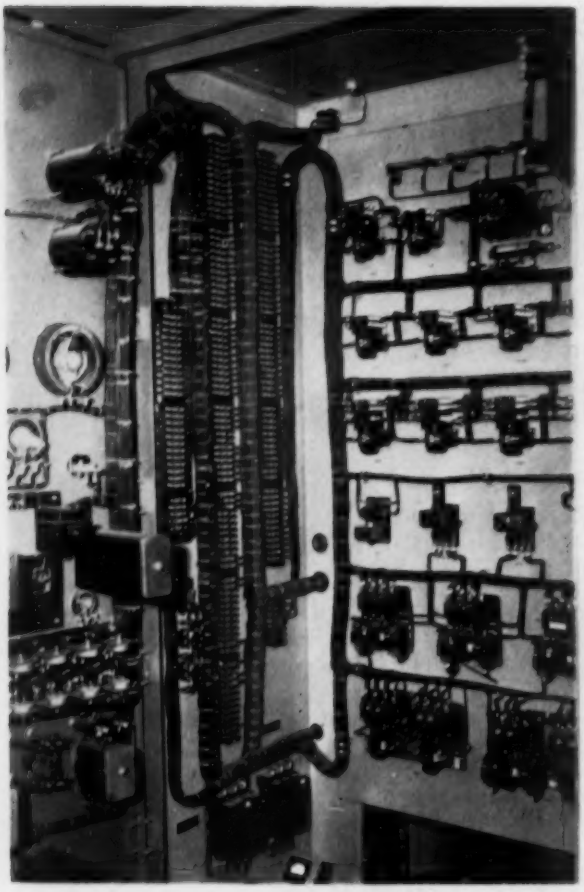
EFFICIENCY is proving to be the significant advantage in the use of the mechanical rectifier, based on our first year of operations at Hooker Electrochemical Company's Montague, Michigan plant. Electrical efficiency runs to about 97 percent which is about 5 percent better than the best competing device. (The high efficiency has a subsidiary advantage in that there is no problem of heat dissipation or rectifier cooling.) Other advantages are low initial cost and reduced powerplant space per installed kva (resulting in reduced capital investment).

The first four units (Numbers 1, 2, 4, and 5) were installed and put on the line in March, 1954. Each rectifier is rated 10,000 amperes at 400 volts, dc. Power to each unit comes from an outdoor transformer, Type OA, rated 4657 kva at 13.8 kv, primary. No-load tap changing permits adjusting for major, permanent load changes.

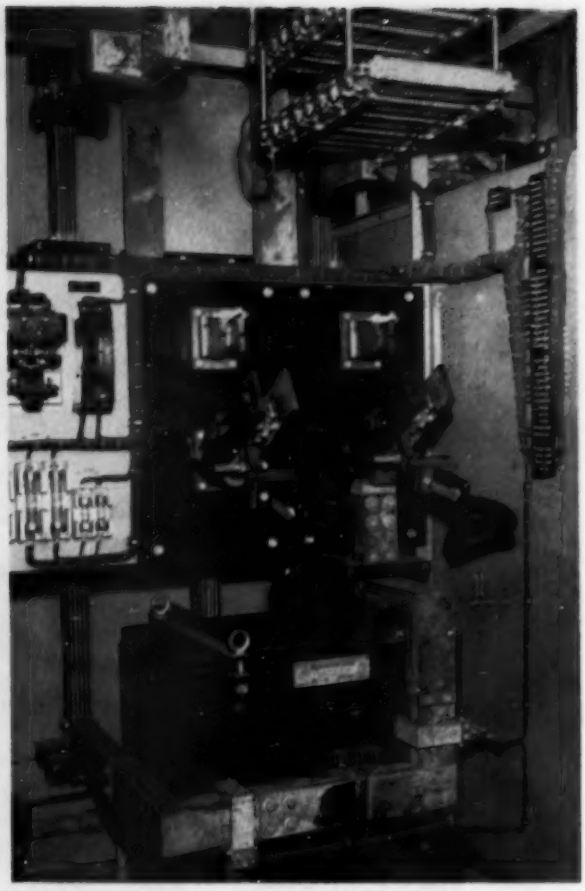
A 4600-kva phase-shifting transformer is used on the 13.8-kv side to permit multiphase operation. Multiphase operation is necessary wherever rectification takes place to eliminate reflections of harmonics from the rectifier back into the ac supply lines. Such harmonics would disturb adjacent telephone lines.

Eleventh harmonic shows up

At light loads, the rectifiers would run about 85 percent power factor, lagging. At full load, they



The interior wiring of the mechanical rectifier is a fine example of the modern methods of packaging electrical gear.



On the outgoing side of the mechanical rectifier is this switching equipment for control of the direct current.

would run about 96 percent, lagging. Power factor improvement seemed advisable, so a bank of static capacitors was installed. It developed, however, that the combination of the capacitors and the rectifier system inductances produced a resonance condition generating a strong eleventh harmonic. A second capacitor bank was added, and the situation improved considerably. A third bank helped even more in correcting the harmonic distortion as well as the power factor.

Runs 98% efficient

The mechanical rectifier system now runs at least 98 percent, leading. The power factor correction is supplied by a bank of outdoor, Pyranol-insulated static capacitors, each rated 2700 kvar at 13.8 kv.

Of course, there are some disadvantages inherent in the mechanical rectifier. These stem from reasons as unique as the device itself. Basically, the rectifier is nothing more than a switch, driven by a synchronous motor. The switching action is timed so that the flow of incoming a-c current is interrupted and turned around during an allowable commutating period in which the a-c current wave passes through zero. Thus, the alternating current is successively "turned around" so that current flows out of the rectifier in one direction only — as direct current.

The vulnerability of the mechanical rectifier (and every breed of machine has some vulnerability), lies in the possibility that the timing of the switching action might go "off." That is, the switches in the mechanical rectifier might open not during the allowable commutating period of zero ac current but at some instant when current was actually flowing. An arc would form, and arcing damage on the contacts would result. There are two ways that the switching action would get out of step. A lightning or switching surge could distort the incoming sine wave in terms of amplitude, phase, or frequency. Or, a voltage disturbance could cause a dip that would permit the synchronous motor driving the switching cams to fall out of synchronism. In either case, the time relation between the incoming a-c current wave and the mechanical switching cycle would be destroyed — and switching action might take place when current through the switching contacts was not zero but was some appreciable value.

Lightning causes backfire

"Backfire" is the term used to describe the arc that occurs when the rectifier gets out of step. Distortion of the incoming wave by lightning surge is the biggest single cause of backfire at our Montague

plant. A surge that distorts the incoming wave's peak more than 15 percent (undervoltage or overvoltage) will cause a backfire. There is apparently a sympathetic reaction that occurs when one rectifier backfires. All the others connected to the d-c bus experience a "sympathetic" backfire. (The manufacturer, I-T-E Circuit Breaker Company, advises that the problem of sympathetic backfiring has been overcome at other installations, and that it is reasonable to believe that the tendency toward backfiring at the Montague installation also will be overcome.)

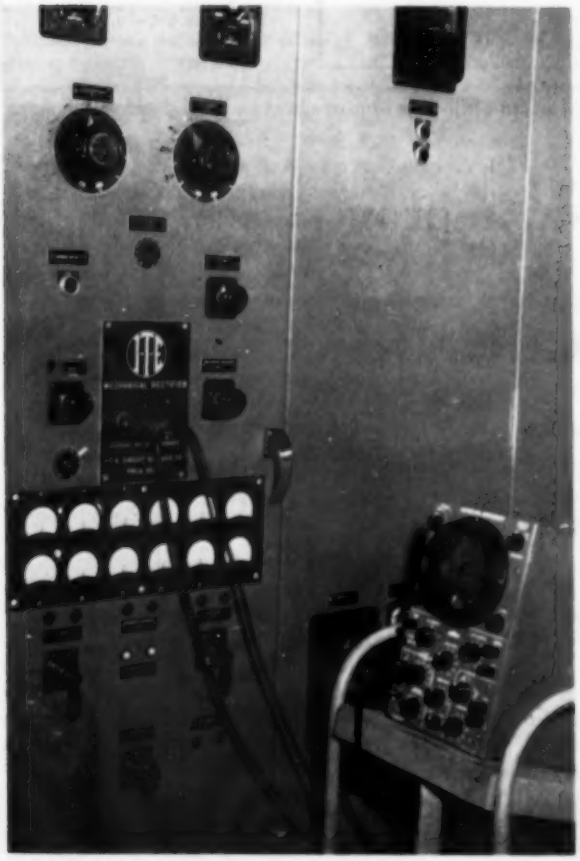
Distortion of the incoming wave form from the sine-wave shape is the major cause of backfire. However, a voltage dip to 40 or 50 percent of the nominal rating in the supply to the synchronous motor may permit the synchronous motor to drop out of step. Or a metallic particle between contacts may bridge the contact gap and induce a backfire.

Though contact life was one of the widely discussed aspects of the mechanical rectifier when it was first introduced in this country, the Montague staff's experience is that backfires account for far more contact replacement than does wear as such. The Montague rectifiers have had contacts that have run well over 1200 hours with no wear problems. Other users report as many as 4,000 hours of rectifier operation without contact failure.

Contact changing downtime

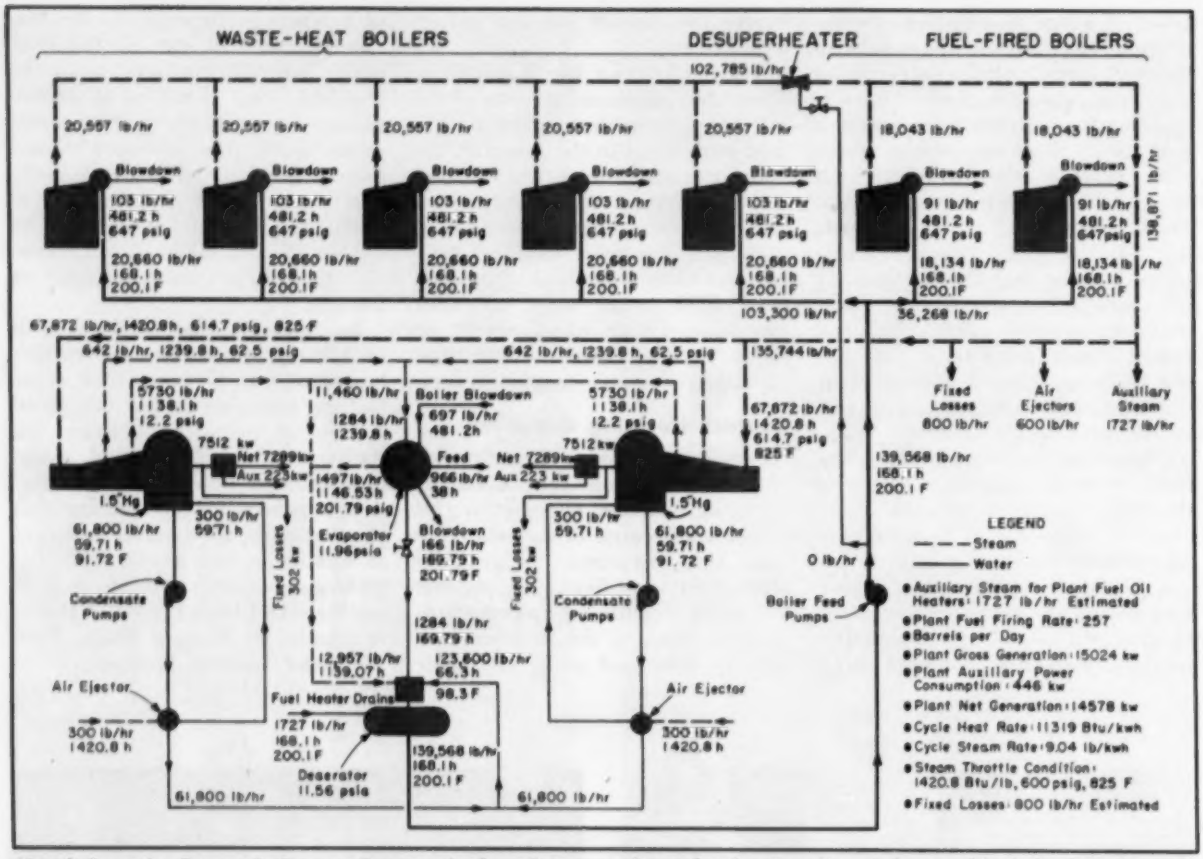
Downtime due to backfire, or any other reason that demands changing contacts, is something of a problem because of the relatively long time required to get the mechanical rectifier back on the line again. The tuning-up procedure requires running the rectifier on a dummy base load while each pair of contacts is "timed." As the machine is brought up to full load, each pair of contacts must be checked. This checking is accomplished by switching an oscilliscope across each pair of contacts and adjusting until the contacts make and break at the proper time as indicated by the wave on the oscilliscope. It takes at least one-half hour to get each machine on the line.

In spite of the troubles with backfiring, the mechanical rectifier has proved to be more than satisfactory considering the combined factors of over-all efficiency, installed cost, space occupied, maintenance, and downtime. That this is so is proved by the fact that this installation of mechanical rectifiers at Montague was made after extensive experience with mechanical rectifiers had been logged at Hooker plants in Niagara Falls, New York and Tacoma, Washington.



Control panel is compact. The oscilliscope is used to synchronize the opening and closing of the rectifier contacts.

Eugene Degen, cell power operator, checks the switchgear feeding incoming a-c power to the Number 5 rectifier.



Heat balance for Riverside Cement Company's plant shows coordinated utilization of waste heat and fuel-fired supplement.

While air cleaning efficiency improves . . . .

I&P EXCLUSIVE

WASTE heat makes power

R. L. BOULDEN
Riverside Cement Co.
Riverside, Calif.

D. B. CARSON
General Electric Co.
Los Angeles, Calif.

J. D. ROSENBLATT
Bechtel Corp.
Los Angeles, Calif.

WASTE HEAT is being captured in sufficient quantities from a dust recovery process to make generation of steam and electric power feasible—at the same time improving the efficiency of the dust recovery process. Increasing production rates, and relentless load growth forced a thorough study of Riverside Cement's power services, resulting in utilization of waste heat as part of a well-integrated modernized industrial power services system.

Operations were started at the plant in 1910 with a daily production of 700 barrels and an electrical demand of about 750 kw. Today, the plant is producing approximately 11,000 barrels per day with an electrical demand of about 13,300 kw.

In 1946, when the plant was modernized electrically, it appeared that a 2000-ampere, 2400-volt main breaker would accommodate any foreseeable future expansion. By 1952, however, it was necessary to split up the bus and tie direct to the power company bus to carry increased load. This forced a split bus arrangement.

Fault current grew

As is usually the case, the available fault current increased as the electrical system grew. Checks on

capabilities of the system indicated that the momentary rating of the 2400-volt circuit breakers would soon be exceeded. In 1952, therefore, the circuit breakers were modernized to increase the momentary ratings from 40,000 to 60,000 amperes. Interrupting ratings were raised from 100,000 to 150,000 kva.

Electrical load continued to grow. Consequently, the available short-circuit currents had increased until the momentary currents now available at the bus were practically up to the modernized circuit breaker rating. Solution of the short-circuit problem would be a necessity in any future system expansions.

Gradual expansion of the electrical system brought about other problems. The load in the quarry increased to the point where the addition of any future loads would present a problem of low voltage. As the system became more extensive, it was noted that faults in one portion of the system were communicated to other sections of the plant. Particularly disturbing was the fact that almost every time a ground fault was experienced in the quarry, coils would be lost in at least one of the plant's large 2300-volt motors—apparently due to overvoltage. Since the power system in the quarry is quite susceptible to fault due to lines dropping, cables being run over, and so forth, these costly motor failures in the plant were being experienced much too frequently.

Consider three approaches

Realizing that the system would continue to expand and that power generation from waste heat was a possibility, preliminary studies were made of the electrical system to determine the best approach. Considered at the time were:

¶ Expansion of the 2400-volt system, utilizing the split bus with synchronizing reactors to limit short-circuit current to 150,000 kva; or

¶ Conversion of all utilization equipment to 4160-volts with continued expansion of the system at this voltage; or

¶ Distribution of power at 13.8 kv, with transformation to 2400 volts for the large motors and to 480 volts for smaller motors.

Studies indicated that the best approach would be to continue expansion of the 2400-volt system, considering:

¶ The compact nature of the plant with the high concentration of horsepower;

¶ The large number of existing 2300-volt motors; and

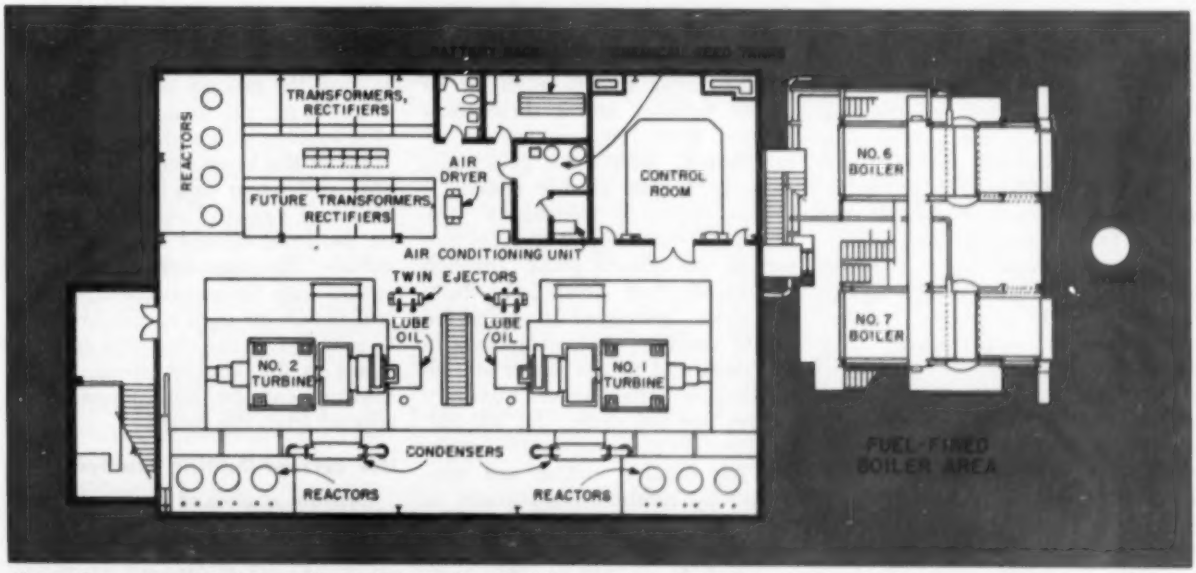
¶ The existence of modern and adequate 2400-volt switchgear and load-center unit substations.

Each cement kiln flue is equipped with a modern combination mechanical-electrostatic precipitator. The efficiency of the precipitators could be improved by reducing the temperature and velocity of the gases passing through them. Temperature and velocity could be reduced by passing the kiln gases through such a device as a waste-heat boiler, the steam thus generated being used for power generation.

Available records established that the cement plant load was about 13,300 kw. Expansion of mill facilities in the future is expected to result in a load increase of 3000 kw—making the average total load approximately 16,000 kw. The calculated power in the kiln gases recoverable in waste-heat boilers is equivalent to 10,800 kw, so some additional energy from either fuel-fired local generation or purchase from the utility would be required.

Study indicated that it would be economical to build a powerplant initially of sufficient capacity to supply the maximum anticipated future load. The powerplant consists of five waste-heat boilers and two fuel-fired boilers, all of which supply steam to two 7500-kw turbine-generators. The waste-heat boilers are installed in the gas discharge end of the cement plant kilns and serve two purposes:

¶ They reduce the velocity and



General arrangement of upper level of the turbine building, with fuel-fired boiler area to the east. Turbine building is 90 feet long and 67 feet wide. East of the fuel-fired boiler area are the water treatment facilities (not shown here).

temperature of the kiln flue gases and thereby increase the effectiveness of the dust removal equipment. ¶ They supply steam for power generation.

The fuel-fired boilers supply the difference between the turbine requirements and the waste-heat steam output. The turbine-generators supply the total electrical requirements of the cement plant. No outside source of power is connected to the system.

The plant is of semi-outdoor construction. The boilers are the outdoor type. The turbine-generators and their accessories are installed indoors in a turbine-generator building. A centralized control room in this building enables one operator to control the boilers, the turbine-generators, and other major equipment.

Turbine building air conditioned

The turbine-generator building has an air conditioning system that consists of an air cleaner, an air washer cooler, and roof exhaust fans. The incoming air passes through the cleaner first, where approximately 90 percent of all dust particles are removed. The air then passes through a fine mist of water in the cooler, and the cooler fan distributes the air throughout the building. Roof exhaust fans continually remove air from the inside.

The waste-heat boilers are installed between the kiln discharge and dust precipitators. Steam output is dependent upon the kiln flue gas temperature and flow. Based upon the minimum and maximum kiln production rates and the flue gas temperatures, the output of a waste-heat boiler will vary between 17,000 and 23,000 pounds per hour. No attempt is made to control this output from the steam load aspect.

Each waste-heat boiler is of the two-drum, bent tube design and is equipped with a pendant type, welded joint superheater and finned-tube economizer. The kiln flue gas enters the boiler at approximately 1250 F and passes through the superheater and the water-tube screen between the upper and lower drums. The gases then pass through the economizer to heat the incoming boiler feedwater. They leave the economizer at approximately 400 F.

The gases from the kilns carry large amounts of cement dust which deposit in the boiler and economizer tubes. This dust is removed with twelve soot blowers—six for the boiler section and six for the economizer section. Each oil-fired boiler is provided with but five soot blowers to remove oil slag and soot from the boiler and air preheater section. In addition to soot blowers, each waste-heat boiler is equipped with four soot hoppers, three under the boiler section and one under the economizer section. Each hopper is insulated, is lined with brick, and contains an observation or access door. When the operator observes dust accumulating, it is removed through a slide gate and goes into a screw conveyor that carries it to waste.

Superheated steam (Fig. 2) enters the throttle of the two turbines at a pressure of 600 psig and a temperature of 825 F. The turbine exhaust steam is condensed in a condenser for each turbine. It is then pumped to a single, common deaerator that receives extraction steam from both turbines. Cooling water for the main condensers is obtained from a cooling tower system. Plant make-up requirements are supplied by an evaporator that receives extraction steam from both turbines.

Generators feed divided bus

Each main generator is connected through three single-phase duplex reactors and two air circuit breakers to a divided 2400-volt bus. Each section of bus is connected to a synchronizing bus through an air circuit breaker and a three-phase reactor. With this unit system arrangement, additional generating capacity can be readily added.

The 2400-volt switchgear supplies power directly to all large motors in the cement plant. Through load-center unit substations, 2400-volt power is stepped down and fed to the smaller 480-volt motors in the plant and to the power station auxiliaries. The larger auxiliary motors are fed from the 480-volt bus through drawout circuit breakers. The smaller motors are controlled by combination starters in motor control centers. Power for cold start-up and emergencies is provided by a 150-kw diesel-engine-driven alternator.

Each of the main generators is a 2400-volt, 60-cps, 3600-rpm, air-cooled machine rated 7500 kw at 80 percent power factor. Each end of each winding is brought out beneath the generator with the neutral of each grounded through a resistor bank rated 1.16 ohms, 1390 volts, and 1200 amperes for 10 seconds with a maximum temperature rise of 500 C. The exciters are direct-connected. Automatic voltage control is obtained with direct-acting regulators.

Each generator is protected by high-speed differential relays, overcurrent relays with voltage restraint, a ground relay in the differential relay circuit, and a back-up ground relay in the generator neutral circuit.

Full ground current protection

The current-polarized, directional overcurrent relay was incorporated into the differential protective scheme to provide full differential protection with less-than-normal ground current flow. For wye-connected generators with differential relays, it is generally considered that satisfactory relaying for ground fault currents requires that the neutral grounding resistor allow a ground current to flow at least equal to the current rating of the current transformers—which in this case is 3000 amperes. With both generators on the system, the ground current would be 6000 amperes, a value considered to be too high. Using the polarized directional overcurrent relay, it was possible to limit the ground current to 1200 amperes per machine and still provide winding differential protection.

All of the breakers in the generator switchgear can be tripped by means of a control switch mounted on the front hinged door of each cubicle. The breakers cannot be closed with these switches. A control switch for each circuit breaker is mounted on the electrical control board in the control room. Each breaker can be both closed and tripped from this board.

Use current-limiting reactors

Because studies of the plant electrical system indicated that it was not economical to change the cement plant distribution voltage from 2400 to 4160 volts, it was

necessary to utilize the current-limiting reactor to limit the short-circuit kva contributed by both generators and by the cement plant motors (which are mainly synchronous) to within the interrupting rating of the air circuit breakers in the 2400-volt switchgear. The electrical system was set up on a d-c network analyzer, and short-circuit studies were made to determine the proper value and division of reactances to limit the short-circuit currents without unduly affecting the transient stability of the system. Duplex, rather than series, reactors were used because the mutual inductance reduces the effective reactance when current flows in parallel through each section, which is the normal operation. The reactance is increased when current flows through the two sections in series.

Centers for auxiliaries

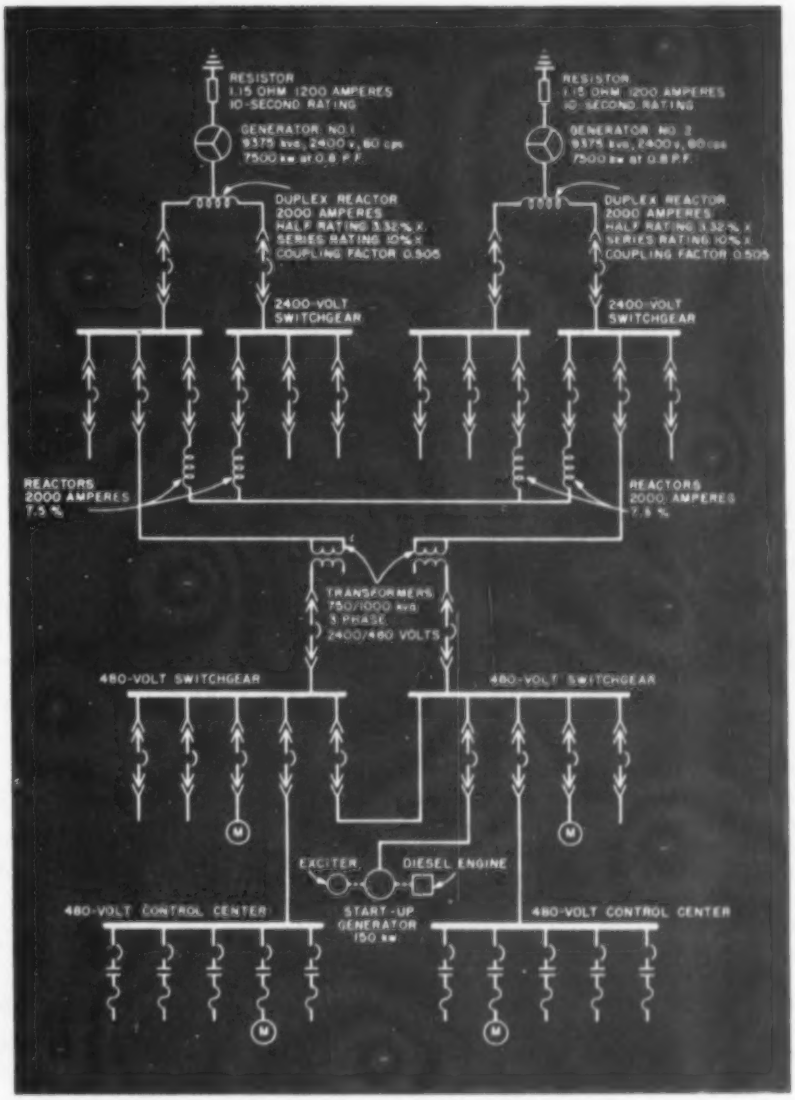
Two 480-volt load centers located in the powerplant furnish power for station auxiliaries. Each load center consists of a 750-kva three-phase dry-type transformer, a metal-enclosed switchgear section, and a motor control section with combination starters and molded-case circuit breakers. The secondary neutrals of the transformers are brought out through bushings, but will not be grounded initially. Since the neutrals are available, the banks can be grounded at a later date if operating experience proves this to be desirable.

The two 480-volt buses are connected with a 480-volt tie breaker. The tie breaker is normally open, and is so interlocked with the two main 480-volt breakers that it cannot be closed when the two main breakers are both closed.

Direct to control centers

One of the 480-volt switchgear feeder circuit breakers supplies power directly to the motor control center bus. Combination starters in the control center supply power to motors rated, in general, from 1 hp to 40 hp. Molded-case circuit breakers supply power to the other loads.

Two induction disc undervoltage relays with adjustable time delay and auxiliary relays are provided on the 480-volt switchgear to automatically close the bus tie breaker when the power supply to either load-center transformer fails.



Generators are connected to plant system through duplex reactors. Synchronizing bus is tied in through reactors. Future generators can be added easily.

Voltage relays operate from potential transformers connected to the 480-volt bus between each load-center transformer and its associated main 480-volt breaker. If the secondary voltage of either transformer fails, the undervoltage and auxiliary relays trip the associated main breaker and close the tie breaker—but only if voltage exists on the other bus. Because the potential transformers are located on the transformer side of the main breaker, the undervoltage relay will not operate and the tie breaker will not be closed when the main breaker is tripped manually. If the main breaker is tripped on overcurrent, the pick-up of the auxiliary transfer relay is blocked.

The low-voltage problem at the quarry was easily solved by the increase in the transmission voltage. A 1000-kva setup transformer bank was installed at the plant to provide 12 kv for transmission. A 1000-kva stepdown bank was located at the quarry to provide 2400 volts for the existing quarry equipment. The only modification necessary in the transmission line was that of re-insulation for the higher voltage level. Initial spacing of the conductors allowed for a future increase in line voltage.

To provide protection to person-

nel in the quarry, it was recommended that the neutral of the power system be grounded through a resistor that would limit the ground current flow to 50 amperes or less, and that a metallic return path be provided with a resistance of less than 2 ohms so that the voltage to ground upon a ground fault in the portable equipment would be 100 volts or less.

Installation of the step-down transformer bank at the quarry offered the opportunity to derive the system neutral for grounding, with very little additional expenditure, by using transformers with wye-connected secondaries to give 2400-volts, line-to-line, and 1385 volts, line-to-neutral. The neutral was then grounded through a 27.8-ohm resistor to limit the ground current flow to 50 amperes. A ground overcurrent relay was installed to trip the quarry circuit breaker in case of ground faults.

Tests and operating experience gathered since the installation of the grounding equipment indicate the relaying to be very sensitive and fast-acting. In one case, the ground return in the shovel trailing cable was purposely opened and one phase line was grounded to the shovel frame. Upon establishment of the ground, the system immediately relayed out.

As mentioned earlier, frequent loss of large motors was experienced due to grounds developing on the ungrounded 2400-volt systems. It is well established that transient overvoltages of considerable magnitude may develop on ungrounded systems. It has been also shown that proper grounding of such a system will reduce these overvoltages to values which are not normally damaging to motors and similar equipment.

Temporary grounding

With these facts in mind, it was decided that the 2400-volt system ultimately would be grounded at the neutrals of the generators. Since the installation of the generators was still several months away, consideration was given to ways and means of providing a temporary system ground.

Since system grounds may be established through wye-delta banks, the quarry line stepup bank was considered for this purpose. A check of the zero sequence impedance of the bank indicated that it was within acceptable limits, so it was decided to use the bank as a temporary grounding point.

The transformers were obtained with the low-voltage windings wye connected to provide 2400 volts, line-to-line, 1385 volts, line-to-neutral. The winding neutral was connected to ground through a resistor which would limit the ground current flow to 1200 amperes. This amount of current was determined to be sufficient to provide proper ground fault relaying. Furthermore, the resistor and associated equipment was ordered so that it could be used as grounding equipment for one of the generators at a later date.

Just temporary

Location of this grounding point for this system is only acceptable as a temporary solution to the problem. Since it is desirable to have the system grounded at all times, the grounding transformer normally should be connected to the system so that it will only be taken off in case of a fault internal to the transformer. Since, in this case, the grounding bank may be tripped off the plant's 2400-volt system in the case of a fault on the quarry line, it does not represent an ideal permanent solution to the problem.

In order to realize the sensitive ground fault protection possible with a grounded system, it was necessary to install residual relays in the 2400-volt switchgear and to equip the 2400-volt motor starters with similar relays. The installation of these relays requires that either three current transformers be used per circuit or that a window current transformer, enclosing all three phase conductors of a circuit be installed.

With the installation of this equipment, proper relay coordination of ground fault conditions is achieved, thus assuring minimum interruption of service due to ground fault.

Location of the new powerplant was governed by the space available near the feed end of the kilns (which is where the waste heat boilers had to be installed). This places the source of the new power about 1000 feet from both the main substation and the distribution center of 48 percent of connected load, and 600 feet from 42 percent of the load. Distance to the center of the remaining 10 percent of the plant load is 200 feet.

Underground duct ventilated

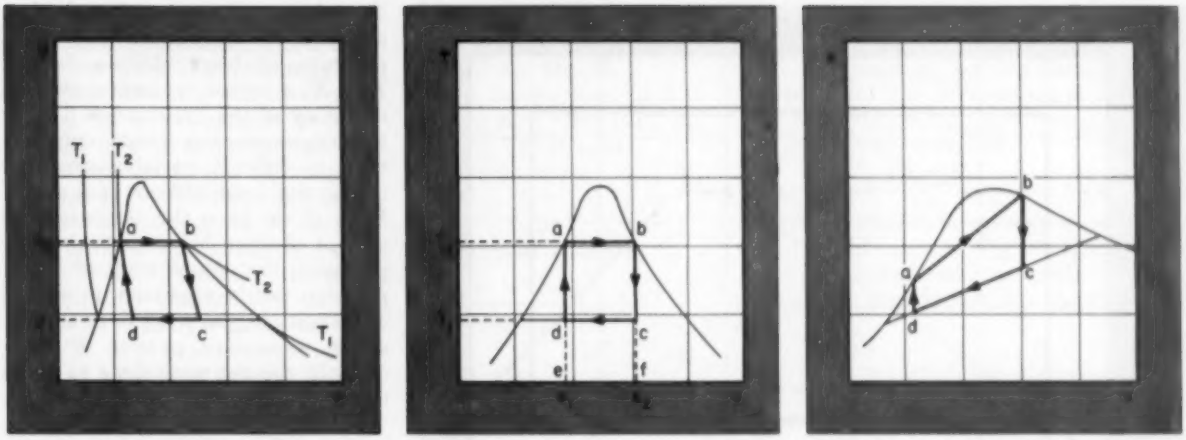
Since underground distribution had been made definite policy by management and engineering a number of years ago, a route for the distribution of waste-heat power had to be selected. The shortest and only feasible route was across and under five large kilns. With earth temperatures of 150 F in summer, a normal installation of fibre duct in a concrete envelope was not feasible because the cables would be overheated in this high-temperature earth. An L-shaped concrete tunnel 5 feet wide and 6½ feet high, with induced draft ventilation, was designed to run due north 190 feet from the powerplant under the five kilns. It was designed to then run due west a distance of 320 feet to connect with an existing distribution vault.

Ventilation is provided by a 30,000-cfm axial flow fan at the turn in the tunnel to draw air from both ends. Suitable louver type dampers are installed at each end of the tunnel. With this type of ventilation, a maximum ambient air temperature of 110 F and a maximum conductor copper temperature of 75 C are anticipated.

The feeder cables selected for this installation are 750 mcm, 5 kv, nonshielded with 11/67 Butyl insulation and a Neoprene jacket. The cables are supported on porcelain insulator blocks on standard underground cable racks, and are arranged three per level with six levels on each side of the tunnel.

Cement dust

Recognizing that dust and cement production go hand in hand but that electrical controls function more satisfactorily under dust-free conditions, attempts are made wherever possible to group the electrical control equipment in areas that can be made relatively dust free. The powerhouse is ventilated with washed air, and is kept under a slight positive pressure to prevent accumulation of dust in this area.



Figs. 1a, 1b, 1c — Carnot cycle can be shown on a p-v diagram (left), a T-s diagram (center) and a Mollier diagram.

A Thermodynamics Refresher—IV

From Carnot to Rankine

JOHN F. LEE
Professor of Mechanical Engineering
North Carolina State College

I&P EXCLUSIVE

Start right here to review thermodynamics. Each article in this easy-to-read series stands as a story complete in itself. Single copies of this month's Thermo Refresher, as well as single copies of previous articles in the series, are available to readers without charge.

THE EFFICIENCY of a Carnot cycle depends on the temperatures at which heat is added and rejected. Fig. 1 shows the Carnot cycle on p-v, T-s, and Mollier diagrams. Although the Mollier diagram is the most useful for the practical solution of cycle problems, the p–v and T–s diagrams are more informative.

Beginning at point *a*, saturated liquid water at a pressure corresponding to the desired saturation temperature, T_2, is introduced into the boiler. The enthalpy of vaporization is added to the water by the boiler, and it leaves as dry saturated steam at point *b*. Vaporization takes place at constant temperature, T_2, and constant pressure, p_2. An adiabatic expansion then causes a decrease in temperature to T_1, a decrease in pressure to p_1, and a decrease in enthalpy to the value shown at point *c* in the wet steam region. Hence some of the steam condenses during the expansion process.

Rejection of heat occurs at T_1 and p_1, with the further condensation of the wet steam to point *d*. Finally an adiabatic compression raises the pressure and temperature of the wet steam until it appears as saturated liquid water at T_2 and p_2. The cycle is completed.

The area bounded by the individual processes of the cycle on the p-v diagram represents the net useful work delivered in one cycle. The area bounded by the cycle on the T-s diagram represents the net heat added in the cycle (the heat added minus the heat that is rejected).

Since a cycle returns the system to its initial state, the net change in internal energy is zero. According to the First Law, then, the net useful work developed in the cycle must be equal to the net heat added. Therefore, the areas enclosed on the p-v and T-s diagrams are equal, provided that heat and work are reported in the same units. Mathematically, this is stated

$$\text{Eff}_{th} = \frac{\text{area abcd}}{\text{area abfe}} = \frac{W_{net}}{Q_A}$$

$$= \frac{T_2\,(s_2 - s_1) - T_1\,(s_2 - s_1)}{T_2\,(s_2 - s_1)}$$

$$= \frac{T_2 - T_1}{T_2}$$

Once again we see that the efficiency of a Carnot cycle depends only on the temperatures of the source and sink.

Actual measurement of areas on the p-v and T-s diagrams would greatly complicate the computation of heat, work, and thermal efficiency so we use the Mollier dia-

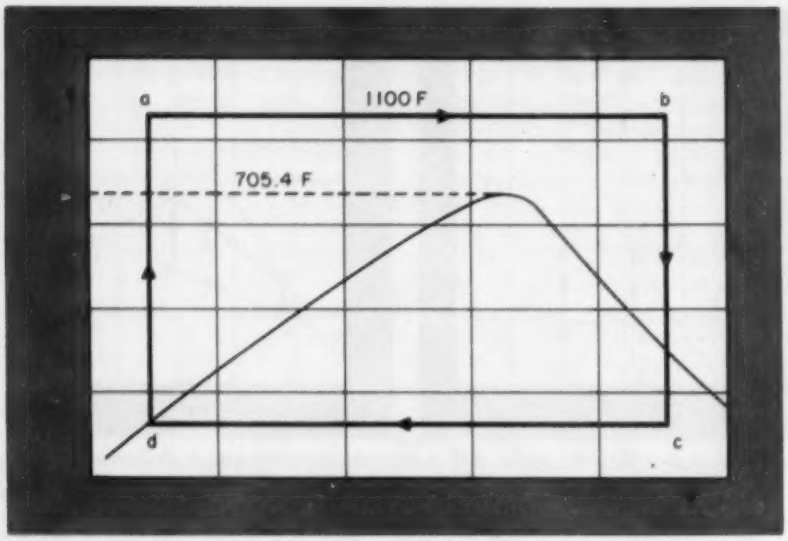


Fig. 2 — Carnot cycle on T-s diagram with highest temperature above critical point (705.4F and 3206.2 psia). Alternative to keeping below 705.4F is an impossible compression range and difficult isothermal heat-addition process.

gram. Referring to Fig. 1c, the heat added, Q_A, is equal to $(h_b - h_a)$. The heat rejected, Q_R, is $(h_c - h_d)$. Then

$$Eff_{th} = \frac{W_{net}}{Q_A} = \frac{Q_A - Q_R}{Q_A} = \frac{(h_b - h_a) - (h_c - h_d)}{(h_b - h_a)} \quad (1)$$

The net work is also equal to the turbine work $(h_b - h_c)$ minus the pump work $(h_a - h_d)$, which will again yield Eq. (1) when substituted in the defining equation for thermal efficiency.

A question now arises as to the practical value of the Carnot steam cycle. Heat is added and rejected at constant temperature and pressure (Figs. 1a and 1b). These processes occurred entirely within the two-phase region. They, therefore, can be approximated very closely by a boiler for the heat-addition process and by a condenser for heat rejection. A highly efficient turbine can provide a reasonable approach to the reversible adiabatic expansion since the steam is expanded rapidly and with very little friction.

The reversible adiabatic compression of a two-phase substance, however, is well-nigh impossible. Equilibrium between the two phases can be maintained if the compression process is executed slowly, but heat transfer to the surroundings prevents an approximation to an adiabatic process. Furthermore, a bulky machine would be required. On the other hand, the process will be essentially adiabatic if compression is carried out rapidly. Each of the two phases also will be compressed adiabatically, however, and there will be negligible heat transfer from vapor to liquid. Compression of the liquid phase would be accompanied by a slight increase in temperature while compression of the vapor phase would result in considerable superheating. Consequently, equilibrium between the phases cannot be maintained and reversibility is out of the question.

There are other difficulties with the Carnot steam cycle. At present, there is an upper limit of about 1150 F on the highest temperature achieved in a vapor cycle. For optimum thermal efficiency, all the heat should be added at this temperature. But the critical point for steam is at 705.4 F and 3206.2 psia. So if heat is added at 1150 F, a simple change of phase is no longer possible and isothermal heat addition can take place only at variable pressure—a very difficult feat to accomplish.

Furthermore, if the compression process must start from saturated liquid at the temperature at which heat is rejected, and go to 1100 F (as shown by the process *d-a* in Fig. 2), a pressure rise of the order of 100,000 psi would be required. Therefore, we are faced with the alternatives of keeping the temperature of heat addition below 705.4 F, a severe limitation on the efficiency of the cycle, or of a fantastic compression range coupled with a difficult variable-pressure isothermal heat-addition process. Even if we keep the temperature of heat addition below critical temperature, the actual work of compression would approach, in order of magnitude, the work done in the actual expansion process. Consequently, the net work done in each cycle would be very small.

Finally, if source and cycle are considered together, the products of combustion can be cooled only to the highest temperature of the cycle. A large temperature difference exists between source and system, and counterflow heat transfer is impossible because the source is at variable temperature while heat addition in the cycle is at constant temperature. It is clear that heat transfer from source to system is highly irreversible. Hence, the overall thermal efficiency of source and cycle would be considerably lower than is indicated by an analysis of the theoretical cycle alone.

Although the Carnot steam cycle appears to be very desirable from a theoretical standpoint, it is impractical to build such an engine. The Thermal efficiency of the real cycle would be poor because of the highly inefficient compression process and upper temperature limit of less than 705.4 F. The net work developed in one cycle would be small. The efficiency of utilization of energy in the source would be poor.

Summary of Symbols

A = area
c = specific heat
h = specific enthalpy
J = mechanical equivalent of heat
m = mass
p = pressure, lbs/in^2 abs
P = pressure, lbs/ft^2 abs
q = rate of heat transfer
Q = quantity of heat
R = gas constant (pv = RT)
s = specific entropy
S = entropy
t = temperature F or C
T = absolute temperature
v = specific volume
V = volume and velocity
W = work

To emphasize these points, let us calculate the performance of a Carnot steam cycle. The conditions given in this problem will be carried throughout these articles so that a comparison of the performance of the various cycles can be made.

EXAMPLE 1. A Carnot steam cycle operates between a source temperature of 600 F and a sink temperature of 60 F. Determine the thermal efficiency and the ratio of turbine work to compression work (a) when all processes are reversible, and (b) when the internal engine efficiency of the turbine is 80 percent and that of the compressor is 60 percent.

(a) When all the processes are reversible, the thermal efficiency is

$$\text{Eff}_{th} = \frac{T_2 - T_1}{T_2} = \frac{1{,}060 - 520}{1{,}060} = 51\%$$

Referring to Fig. 1 and the steam tables, we obtain

$h_b = 1{,}165.5$ Btu/lb

and $s_2 = s_b - s_e = 1.3307$ Btu/lb-F

The quality at c is

$$x_c = \frac{1.3307 - 0.0555}{2.0393} = 0.625$$

Therefore, the enthalpy at c is

$h_c = 1{,}088.0 - (1 - 0.625)\,(1{,}059.9)$

From the steam tables we get

$h_a = 617.0$ Btu/lb,

$s_1 = s_a = s_d = 0.8131$

and the quality is

$$x_d = \frac{0.8131 - 0.0555}{2.0393} = 0.372.$$

Hence the enthalpy is

$h_d = 1{,}088.0 - (1 - 0.372)\,(1{,}059.9) = 422$ Btu/lb

The turbine work for an isentropic expansion is

$W_{turb} = (h_b - h_c) = 1{,}165.5 - 690 = 475.5$ Btu/lb

and isentropic compressor work is

$W_{comp} = (h_a - h_d) = 617 - 422 = 195$ Btu/lb

Therefore the ratio of turbine to compression work is

$$\frac{W_{turb}}{W_{comp}} = \frac{475.5}{195} = 2.44$$

(b) If the internal efficiency of the turbine is 80 percent, the actual enthalpy of the steam leaving it is

$h_c' = h_b - \text{eff}_{et}\,(h_b - h_c) = 1{,}165.5 - 0.80\,(1{,}165.5 - 690) = 785.5$ Btu/lb

Similarly, the actual enthalpy after compression is

$$h_a' = h_d + \frac{1}{\text{Eff}_{ec}}\,(h_a - h_d) = 422 + \frac{1}{0.60}\,(617 - 422) = 747 \text{ Btu/lb}$$

The internal work of the turbine is

$W_{turb} = (h_b - h_c') = 1{,}165.5 - 785.5 = 380$ Btu/lb,

and for the compressor it is

$W_{comp} = h_a' - h_d = 747 - 422 = 325$ Btu/lb

The work ratio is

$$\frac{W_{turb}}{W_{comp}} = \frac{380}{325} = 1.17$$

The thermal efficiency is

$$\text{Eff}_{th} = \frac{(h_b - h_a') - (h_c' - h_d)}{h_b - h_a'} = \frac{(1165.5 - 747) - (785.5 - 422)}{1165.5 - 747} = 13\%$$

Note carefully the severe decreases in thermal efficiency and work ratio because of the irreversibilities.

Modify Carnot cycle

The Carnot cycle is wholly impractical, but perhaps it can be modified to give a cycle that is practical. Suppose we continue to reject heat in the condenser of the Carnot cycle until saturated liquid water at the temperature of the sink (or the pressure in the condenser) is reached. We then have a reversible Rankine cycle as represented by the heavy lines on the p-v, T-s, and Mollier diagrams of Fig. 3.

The saturated liquid water (boiler feedwater) at point d is pumped to boiler pressure with only a slight increase in temperature and enthalpy to point e. The water then is raised to the saturation temperature at point a in a constant-pressure process. Vaporization takes place from a to b within the boiler.

Note that all the heat is not added at T_2, but some begins to be added at the temperature corresponding to point e. The mean temperature at which heat is added is less than T_2. The efficiency of a Rankine cycle thus is lower than that of a Carnot cycle operating between the same temperature limits.

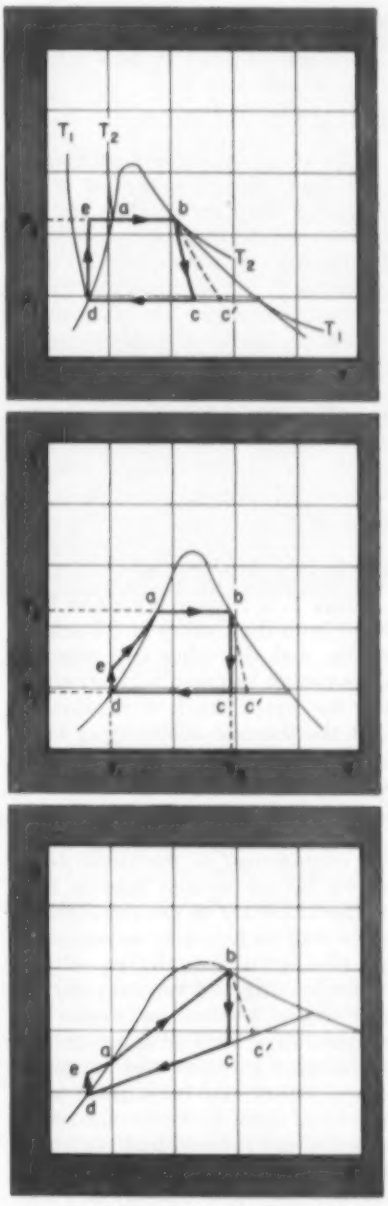
The efficiency of a Rankine cycle can be found readily with reference to the Mollier diagram shown in Fig. 3c. Heat is added, Q_A, from point e to point b. Heat is rejected, Q_R, from c to d. The efficiency may be written

$$\text{Eff}_{th} = \frac{(h_b - h_c) - (h_e - h_d)}{h_b - h_e} = \frac{(h_b - h_e) - (h_c - h_d)}{h_b - h_e} = \frac{W_{net}}{Q_A} \qquad (2)$$

This expression for the efficiency in terms of enthalpy differences is the same as for the Carnot cycle, except for differences in labeling the diagrams. However, Eq. (2) does not reduce to

$$\text{Eff}_{th} = \frac{T_2 - T_1}{T_2}$$

The reason is clear from the fact, readily seen in Fig. 3b, that heat is not added entirely at T_2. Now we have already seen how the efficiency



Figs. 3a, 3b, 3c — Rankine cycle on p-v diagram (top), T-s diagram (center), and Mollier diagram (bottom).

of any cycle may be expressed as

$$\text{Eff}_{th} = \frac{Q_A - Q_R}{Q_A}$$

Since all processes in a reversible cycle must be also reversible, we may define the mean effective temperatures at which heat is added and rejected respectively as

$$T_{mA} = \frac{Q_A}{\triangle s_A} \text{ and } T_{mR} = \frac{Q_R}{\triangle s_R}$$

Referring to Fig. 3b we may write for the thermal efficiency

$$\text{Eff}_{th} = \frac{T_{mA}(s_b - s_c) - T_{mR}(s_c - s_d)}{T_{mA}(s_b - s_c)} \quad (3)$$

Since *d-e* and *b-c* are isentropic processes, $(s_b - s_c) = (s_c - s_d)$

Eq. (3) reduces to

$$\text{Eff}_{th} = \frac{T_{mA} - T_{mR}}{T_{mA}} \quad (4)$$

The mean effective temperature at which heat is rejected is the same for the Carnot cycle and for the reversible Rankine cycle since heat is rejected at the constant temperature T_1 in either process. To increase the thermal efficiency of the reversible Rankine cycle, we must direct our attention to the mean effective temperature at which heat is added. This temperature may be increased by increasing T_2, increasing T_c, or adding a larger proportion of the heat at temperature close to T_2.

Reversible Rankine efficiency

Since T_2 is fixed at a limit of 1150 F for both the Carnot and Rankine cycles, and the other two alternatives cannot be taken without altering the cycle itself, it is obvious that the thermal efficiency of even a reversible Rankine cycle must always be lower than that of the Carnot cycle.

The effect of irreversibility on the expansion in the turbine is shown by the broken lines in Fig. 3. The efficiency of the irreversible cycle may be found by substituting h_c' (the actual enthalpy of the steam leaving the turbine) for h_c (the enthalpy after isentropic expansion). The expansion terminates at the same pressure and temperature in either case for a given temperature, since pressure and temperature are independent variables in the two-phase region. However, the enthalpy and entropy are dependent variables. The higher entropy results in a higher enthalpy at the end of the expansion.

A similar correction should be made for the irreversibility in the pumping process from *d* to *e*. The pressure rise is the same for the reversible and irreversible pumping process since it is fixed by the resistance to flow in the piping, by elevation differences imposed by the physical layout of the plant, and by the desired pressure level in the boiler. The increase in entropy owing to the irreversibility results in an increase in the temperature and enthalpy of the liquid leaving the pump or entering the boiler (not shown in Fig. 3).

Rankine exceeds Carnot

The efficiency of an actual engine operating on the Rankine cycle may exceed that of an actual engine operating on the Carnot cycle, particularly when the source and engine are considered together. First, the pumping of a liquid can be accomplished with high efficiency. Second, the efficiency of the furnace is much higher since, theoretically at least, the products of combustion can be cooled to the lowest temperature of the cycle. Third, reversible heat transfer from source to heat engine can be much more closely approximated by counterflow heat transfer. Fourth, pump work is insignificant in comparison with turbine work, and the net work developed in each cycle is large compared with that of a Carnot engine.

EXAMPLE 2. Suppose the Carnot cycle in Example 1 is replaced by a Rankine cycle. Determine the thermal efficiency and the ratio of turbine work to pump work when (a) all processes are reversible and (b) when the internal engine efficiency of the turbine is 80 percent and that of the pump is 92 percent.

(a) Referring to Fig. 3, the steam tables, and the preceding example, we obtain

$h_b = 1{,}165.5$ Btu/lb
$h_c = 690$ Btu/lb
$h_d = 28.06$ Btu/lb
$p_c = p_1 = 1{,}542.9$ psia
$p_d = 0.2563$ psia
$v_d = 0.01604$ cu ft/lb

The isentropic work done in the turbine and pump is

$$W_{turb} = h_b - h_c = 1{,}165.5 - 690 = 475.5 \text{ Btu/lb}$$

$$W_{pump} = \frac{v_d(p_e - p_d)144}{778} = \frac{0.01604\,(1{,}542.9 - 0.2563)144}{778} = 4.59 \text{ Btu/lb}$$

The work ratio is

$$\frac{W_{turb}}{W_{pump}} = \frac{475.5}{4.59} = 103.5$$

This is considerably higher than that of the ideal Carnot cycle. The enthalpy of the water leaving the pump is

$$h_e = h_d + W_{pump} = 28.06 + 4.59 = 32.65 \text{ Btu/lb}$$

The heat added is

$$Q_A = h_b - h_e = 1{,}165.5 - 32.65 = 1{,}132.8 \text{ Btu/lb}$$

The thermal efficiency is

$$\text{Eff}_{th} = \frac{W_{turb} - W_{pump}}{Q_A} = \frac{475.5 - 4.59}{1{,}132.8} = 41.6\%$$

This is not too much more than that of the ideal Carnot cycle.

(b) Considering the efficiencies of the turbine and pump, $\text{eff}_{et} = 80$ percent and $\text{eff}_{ep} = 92$ percent, we get

$$h_c' = h_b - \text{eff}_{et}(h_b - h_c) = 1{,}165.5 - 0.80\ (475.5) = 1{,}165.5 - 380 = 785.5 \text{ Btu/lb}$$

$$h_e' = h_d + \frac{1}{\text{eff}_{ep}}(h_e - h_d) = 28.06 + \frac{1}{0.92}(4.59) = 28.06 + 5 = 33.06 \text{ Btu/lb}$$

The work done in the turbine and pump is

$$W_{turb} = h_b - h_c' = 380 \text{ Btu/lb}$$

$$W_{turb} = h_e' - h_d = 5 \text{ Btu/lb}$$

The work ratio is

$$\frac{W_{turb}}{W_{pump}} = \frac{380}{5} = 76$$

This is considerably higher than that of the ideal Carnot cycle and not too far below that of the ideal Rankine cycle.

The heat added is

$$Q_A = h_b - h_e' = 1{,}165.6 - 33.06 = 1{,}132.5 \text{ Btu/lb}$$

The thermal efficiency is

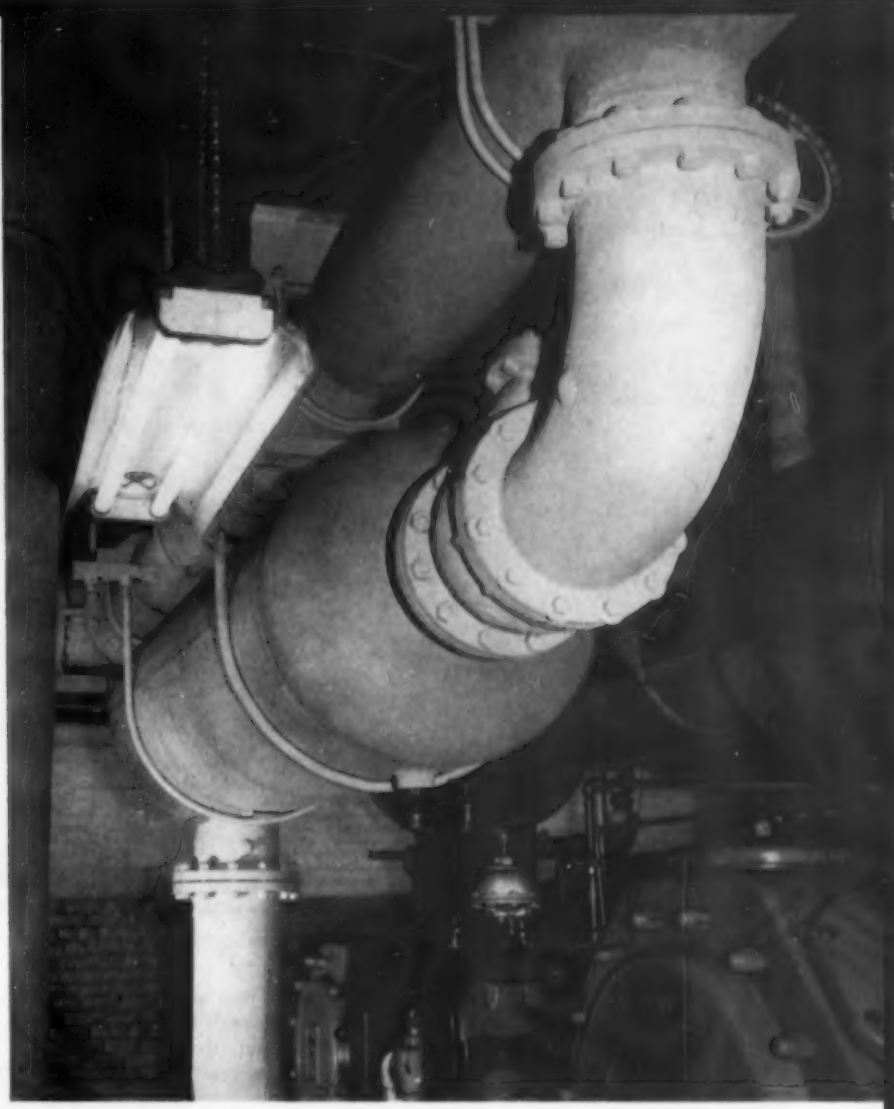
$$\text{Eff}_{th} = \frac{W_{turb} - W_{pump}}{Q_A} = \frac{380 - 5}{1{,}132.5} = 33.1\%$$

Hence, the actual thermal efficiency of the Rankine cycle is much better than that of the Carnot cycle.

Next month: Another article in INDUSTRY & POWER'S Thermodynamics Refresher. Prof. Lee will discuss "The reheat cycle."

Vibration is tamed so simply

I&P EXCLUSIVE



Snubbers were installed as close to compressors as possible, and piping was revamped after welding in place.

J. N. STRAKY, Plant Engineer, DeSoto Division, Chrysler Corporation

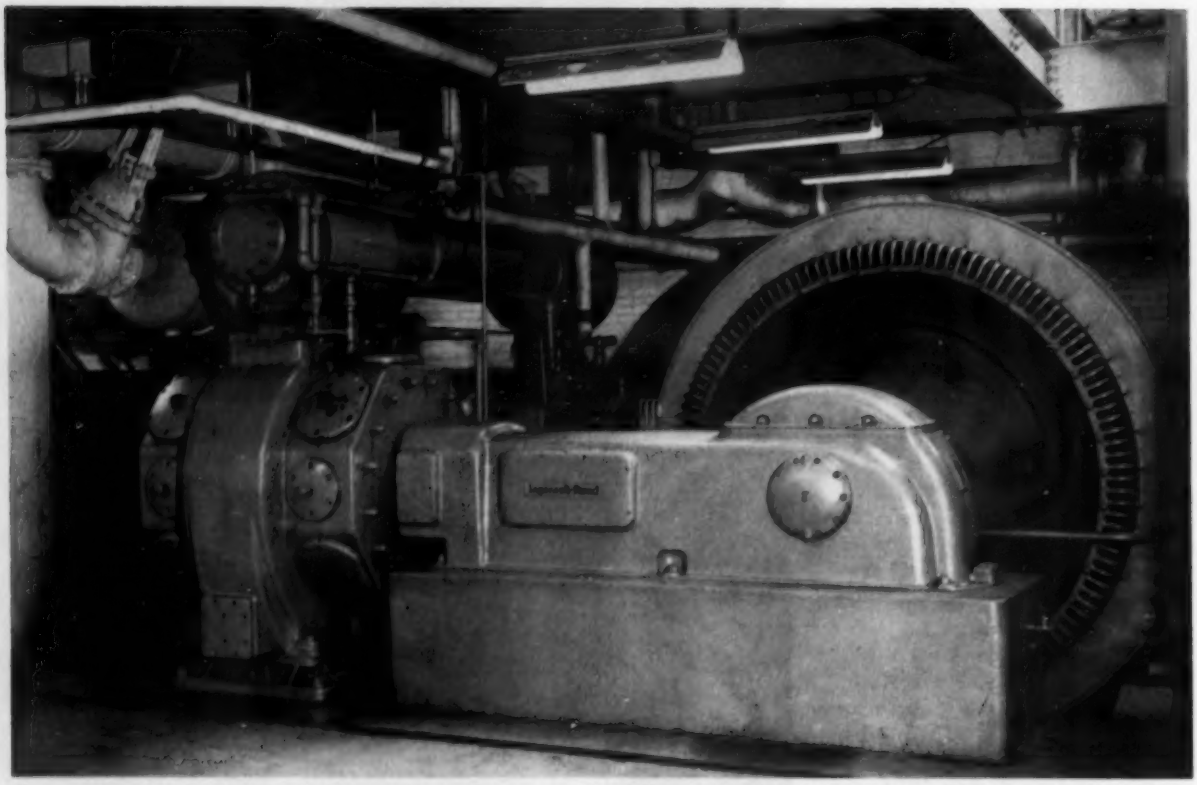
J. N. Straky has been a registered professional mechanical engineer in Michigan since 1945. His early experience consisted of field work in electrical and general construction and as a designer of industrial electrical systems. He has been with Chrysler Corporation for 22 years, starting as electrical engineer with DeSoto when it built its new plant in 1936. He designed the complete power and lighting system. In 1941 he became plant engineer. He handled the wartime conversion to war production and the reconversion back to civilian production. He is a member of the Engineering Society of Detroit and the Society of Automotive Engineers.

HIGH MAINTENANCE and operating costs due to vibration induced by air compressors can be all but eliminated. DeSoto Division engineers found that even in tight places it can be done efficiently, and economically as well.

Piping vibration in compressor rooms often can be traced to the air leaving reciprocating compressors. Although usually more of a nuisance than anything else, this vibration can be of serious proportions. Real trouble often starts when several compressors discharge into a common header and oscillation at some very low frequency occurs. This frequency will be an algebraic result of the sums and differences of the various compressor frequencies.

An extremely serious level of vibration was encountered by engineers at the Warren Avenue plant of Chrysler Corporation's DeSoto Division after they had completed a revamping of their compressor room to make room for a new 3250-cfm compressor. Compressed air at 100 psi is used throughout this plant in the production of automobile engines and bodies. A steady pressure is essential for the use of air-powered tools, sprayers, and production equipment.

Before installation of the 3250-



Compressors were two stage, duplex, reciprocating type with total capacity of 6720 cfm. Latest addition was 3250 cfm unit.

cfm unit, air requirements for the plant were supplied by six Ingersoll-Rand two-stage, duplex, reciprocating compressors with a total installed capacity of 4720 cfm. All units are motor driven, using 220 volts 60-cps power. Each unit is intercooled between stages, and has a receiver and aftercooler.

When compressed air needs for the plant called for an additional compressor, it became necessary to remove an interior wall of the compressor room and to move the air receivers and aftercoolers to a mezzanine floor. The piping was revamped to discharge air from all of the units into a common header leading to the equipment on the mezzanine. This header, at mezzanine floor level, rested on pipe cradles attached to the steelwork.

Vibration starts immediately

When the new compressor was started up, the vibration encountered in the header and the building itself was of such magnitude that it would normally have prohibited operation of the compressors. If either No. 1 or No. 7 (new) compressor was shut down, the vibration stopped immediately, but shutting down the other compressors had no effect. To avoid a shutdown of manufacturing operations, however, it was decided to operate the compressors while the engineering staff searched for a solution. Soon after operation began, the vibration caused welds in the piping to crystallize, resulting in pipe breakage.

To prevent further breakage, the engineers rigidly anchored the header by welding it to hangers, in turn welded to the building columns. This transferred the vibration to the building walls.

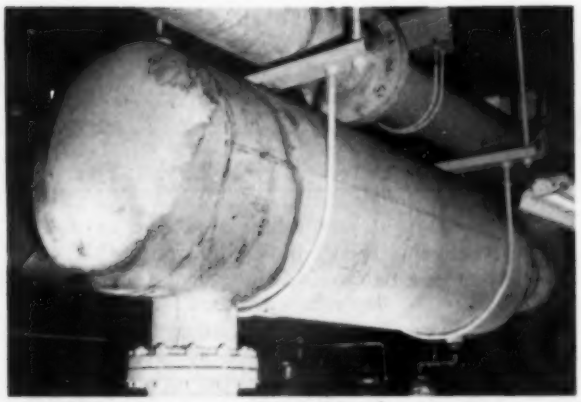
Fluorescent lights fell to the floor and bricks worked loose from the walls, causing hazardous working conditions. Pipe anchors snapped, and welds in the structural steel components of the mezzanine broke. The vibration was so severe that welders attempting to make repairs had difficulty in drawing a bead. Then, large cracks began to appear in the walls in which the header was anchored. The building itself became endangered.

After studying several possible methods of dampening the vibrations (such as the provision of surge tanks), it was decided to install pulsation dampeners, or snubbers, at the discharge end of each large compressor.

Operating principles

These units, which resemble enclosed tanks from the outside, reduce the rate of change of the exciting force at the beginning of the pipe line so that the pressure due to the pumping of gas into the pipe does not pulsate rapidly enough to cause the mass of gas in the pipe to oscillate. They smooth the flow without constriction and stop vibration without any mechanical damping. By reducing accelerations of the surging gas and resultant pulse amplitude, effective surge control was achieved over a wide range of operating conditions.

Two snubbers were installed first —one on the line from two compressors in one room and the other on the line from the most remote compressor. Air from the high-pressure side of the compressors



Header hangers were welded to building columns, sent vibration into walls. Snubbers reduced vibration 90 percent.

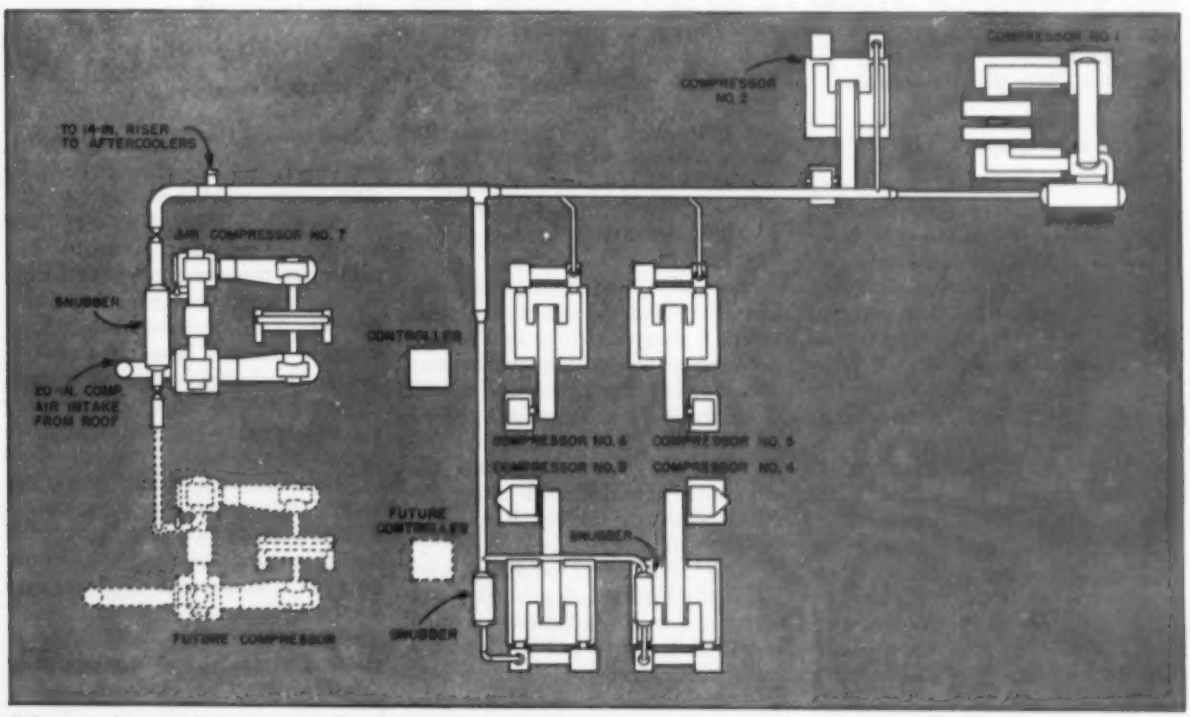
Traps were provided on each snubber to run condensate to drain, but experience shows that very little forms.

passes through the snubbers before entering the common header.

Each of the snubbers installed in this plant is of the side-inlet, end-discharge type. They were installed on weekends when only a small amount of air was being used. Air supply was maintained in the plant by shutting each compressor out of the line in turn. The snubbers were installed as close to the compressors as possible, a section of the pipe being cut out and revamped to accommodate them. They were suspended by pipe hangers from the structural steel work of the floor above. Condensed water from the snubbers was trapped to drain, although experience has shown that very little water condenses here. The snubbers run at a temperature of about 100 F.

When the first two units were found to be effective, two more similar units were installed. The installation of these four snubbers has proved to be highly effective. There has been at least a 90-percent reduction in vibration. Structural vibration is now at a negligible level—perhaps even lower than is usually found in compressor rooms.

In addition, this solution to the problem proved to be quite inexpensive since the unit for the larger compressor cost only $700. The snubbers have required no maintenance in three years except for outside painting.



Schematic layout of compressor room shows positions of seven compressors and four snubbers in relation to main header.

In brief . . . .

AIEE summer meeting

THE 71st ANNUAL meeting of the AIEE, a five-day event at Swampscott, Massachusetts, was told: "The increasing significance of the electrical industry is revealed by its increasing share of the nation's gross product." Sounding this keynote was the out-going AIEE president, A. C. Monteith, vice president in charge of engineering for Westinghouse Electric Corporation. Monteith continued, "From less than two percent of the gross national product in 1925, the electrical industry advanced to four percent in 1950, and by 1965 it will have risen to six percent. If this percentage is integrated with the overall increase of goods and services, we can confidently expect that the electrical industry will double in the next ten years."

Operating experience with a mechanical rectifier

John Chamulak
James W. Tracht
Pennsylvania Salt Manufacturing Co.

William C. McCullough
I-T-E Circuit Breaker Company

"The first 10,000-ampere, sixty cycle mechanical rectifier installed in the United States has now completed 32 months of operation. Anticipated high conversion efficiency has been confirmed. The current supplied the isolated electrolytic load has been controlled well within the required limits. Contact life remains the major maintenance problem. However, recent developments in contact design have increased contact life and give promise of still further increase. . . .

"Calculations based upon the readings of the a-c induction watthour meter and the d-c potentiometer type watthour meter with mechanical integrator have established an efficiency of the rectifier and transformer of 97 percent when operated at 85-percent load. Accuracy of these two meters has been maintained within one-half of one percent under this load. . . .

"Operation with minimum phase control is practiced to obtain best power factor. With no phase control power factor is 0.88 to 0.90, dependent upon transformer tap being used. With phase control the power factor drops off directly as the percentage reduction in d-c output voltage."

Relay response to motor residual voltage during automatic transfers

A. R. Kelly
Esso Research & Engineering Company

"Industrial applications are found for power systems which automatically transfer motor loads from a normal to an alternate supply upon loss of the normal supply. If the motors drive fluid-handling equipment, it may be desirable to restore power very rapidly for two reasons. First, a shorter outage reduces loss of energy in liquid velocities and gas pressures; this decreases the magnitude and shortens the time of the reaccelerating energy demand on the alternate supply after transfer, thus decreasing system disturbance.

"Second, if the fluids are being heated, cooled, or chemically processed, a shorter outage can reduce severity of equipment overheating and thermal shock, and the extent of undesirable or dangerous chemical reactions. Thus systems are frequently designed to complete the automatic transfer and begin reaccelerating the motors before the motors can come to rest. . . .

"The following recommendations are made for applying relays: (1) Motor undervoltage protection must be time-delay type. (2) Motor undervoltage relays must have lower dropout voltage, and longer time at zero volts, than undervoltage relays initiating transfer. If other than induction-disc type time-delay relays are used for motor undervoltage, it is suggested that their operating time at zero voltage be made equal to or greater than the operating time of the induction-disc transfer-initiating relay at 50 percent of normal operating (not pickup) voltage. (3) The operating time of motor undervoltage relays at zero voltage should be at least four to five seconds, whether induction-disc type or not. (4) Relays employed to determine when residual voltage reaches 25 percent should have a dropout voltage independent of frequency from about 25 to 60 cycles. (5) To assure coordination, the transfer-initiating undervoltage relay, motor undervoltage relays, and residual voltage relay should all be connected across the same phase."

New low-voltage air circuit breaker

J. W. Timmerman
O. J. Albani
Allis-Chalmers Manufacturing Company

"The Large Air Circuit Breaker Standards published by AIEE, ASA, and NEMA, like all other similar standards, prescribe the minimum requirements permissible for their particular category of circuit breaker. Obviously, therefore, breaker designs based upon those standards should be liberal enough to anticipate, at least, those trends in application which are clearly apparent at the time.

"The LA-25 breaker presented within this paper recognizes such design obligations. The particular design encompasses many features that are unique, and of true value to the utility and industrial user. The LA-25 breaker . . . . is compact, electrically and mechanically durable, may be easily inspected

(continued on page 62)

TABLE 1 — RELATIVE HUMIDITY FOR DRY AND WET BULB HYGROMETER

Dry bulb temp. —°F	Wet bulb, depression — °F																																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	32	34	36	38	40	45	50
30	89	78	67	57	46	36	27	17	6																												
35	90	81	72	63	54	45	37	28	19	11	3																										
40	92	83	75	68	60	52	45	37	29	22	15	8																									
45	93	85	78	72	64	58	51	44	37	31	25	19	12	6																							
50	93	86	80	74	68	62	56	50	44	38	32	27	21	16	10	5																					
55	94	88	82	76	70	65	60	54	49	44	39	34	28	24	19	14	9	5																			
60	94	89	83	78	73	68	63	58	53	48	43	39	34	30	26	21	17	13	9	5	1																
65	95	90	84	80	75	70	66	61	56	52	48	44	39	36	32	27	24	20	16	13	8	6	2														
70	95	90	86	81	77	72	68	64	59	55	51	48	44	40	36	33	29	25	22	19	15	12	9	6	3												
75	95	91	86	82	78	74	70	66	62	58	54	51	47	44	41	37	34	31	28	24	21	18	15	12	10	7	4	1									
80	96	91	87	83	79	75	72	68	64	61	57	54	50	47	44	41	38	35	32	29	26	23	20	18	15	12	10	7	5	3							
85	96	92	88	84	80	76	73	70	66	63	59	56	53	50	47	44	41	38	36	33	30	28	25	23	20	18	15	13	11	9	4						
90	96	92	89	85	81	78	74	71	68	65	61	58	55	52	49	47	44	41	39	36	34	31	29	26	24	22	19	17	15	13	9	5	1				
95	96	92	89	85	82	79	75	72	69	66	63	60	57	55	52	49	46	44	42	39	37	34	32	30	28	26	23	22	20	17	14	10	6	2			
100	96	93	89	86	83	80	77	73	70	68	65	62	59	56	54	51	49	46	44	41	39	37	35	33	30	28	26	24	22	21	17	13	10	7	4		
105	96	93	90	87	83	80	77	74	71	69	66	63	60	58	55	53	50	48	46	44	42	40	37	35	34	31	29	28	26	24	20	17	14	11	8		
110	97	93	90	87	84	81	78	75	73	70	67	65	62	60	57	55	52	50	48	46	44	42	40	38	36	34	32	30	28	26	23	20	17	14	11	4	
115	97	93	90	88	85	82	79	76	74	71	68	66	63	61	58	56	54	52	50	48	45	43	41	40	38	36	34	32	31	29	26	23	20	17	14	8	2
120	97	94	91	88	85	82	80	77	74	72	69	67	65	62	60	58	56	53	51	49	47	45	43	41	40	38	36	34	33	31	28	25	22	19	17	10	5
125	97	94	91	88	86	83	80	77	75	73	70	68	65	63	61	59	57	55	53	51	48	47	45	43	41	39	38	36	35	33	30	27	24	22	19	13	8
130	97	94	91	89	86	83	81	78	76	73	71	69	67	64	62	60	58	56	54	52	50	48	47	45	43	41	40	38	37	35	32	29	26	24	21	15	10
140	97	95	92	89	87	84	82	79	77	75	73	70	68	66	64	62	60	58	56	54	53	51	49	47	46	44	43	41	40	38	35	32	30	27	25	19	14
150	98	95	92	90	87	85	82	80	78	76	74	72	70	68	66	64	62	60	58	57	55	53	51	49	48	46	45	43	42	41	38	36	33	30	28	23	18
160	98	95	93	90	88	86	83	81	79	77	75	73	71	69	67	65	64	62	60	58	57	55	53	52	50	49	47	46	44	43	41	38	35	33	31	25	21
170	98	95	93	91	89	86	84	82		78	76	74	72	70	69	67	65	63	62	60	59	57	55	53	52	51	49	48	47	45	43	40	38	35	33	28	24
180	98	96	94	91	89	87	85	83	..	79	77	75	73	72	70	68	67	65	63	62	60	58	57	55	54	52	51	50	48	47	45	42	40	38	35	30	26
190	98	96	94	92	90	88	85	84	82	80	78	76	75	73	71	69	68	66	65	63	62	60	58	57	56	54	53	51	50	49	46	44	42	39	37	32	28
200	98	96	94	92	90	88	86	84	82	80	79	77	75	74	72	70	69	67	66	64	63	61	60	58	57	55	54	53	52	51	48	46	43	41	39	34	30
210	98	96	94	92	90	88	86	85	83	81	79	78	76	75	73	71	70	68	67	65	64	63	61	60	59	57	56	54	53	52	50	47	45	43	41	36	32

Forest Products Laboratory, USDA

THINK about steam humidification now . . . .

Why let winter ROB YOU again?

DONALD HARTLEY
Associate Editor

EXCLUSIVE

YOUR COMPANY'S profits are very closely connected with the amount of moisture in the air in your plant. From about October to April, the doors and windows are closed. Heat is turned on most or all of the time. This dries out the air and causes all kinds of operating difficulties and losses.

Relative humidity is a simple expression of the amount of moisture actually present in the air at a specified temperature as compared to the maximum amount of moisture the air *could* hold at that temperature. To say that relative humidity is 100 percent means that the air is saturated and cannot absorb any more moisture at the existing temperature. Relative humidity of 20 percent means that the air is only 1/5 saturated and can hold five times as much moisture at that temperature.

The warmer the air is, the more moisture it can hold. A cubic foot of air at 70 F can hold nearly 23 times as much moisture as a cubic foot of air at 0 F. Thus, if the temperature of the air is increased and no more moisture is added, relative humidity drops (Table 1). The measuring of relative humidity is done with an inexpensive hygrometer.

Moisture from somewhere

If you increase the air temperature without adding moisture, the air will draw moisture from any available source. Too often, it doesn't have to get very cold out-

TABLE 2 — WEIGHT OF WATER IN 10,000 CUBIC FEET OF AIR AT 75 PERCENT AND 50 PERCENT RELATIVE HUMIDITY.

Degrees Farenheit	75% R.H.	50% R.H.
—20	0 lbs 2.8 oz	0 lbs 1.9 oz
—10	0 lbs 4.9 oz	0 lbs 3.2 oz
0	0 lbs 8.1 oz	0 lbs 5.4 oz
10	0 lbs 13.3 oz	0 lbs 8.9 oz
20	1 lb 5.3 oz	0 lbs 14.2 oz
30	2 lbs 1.4 oz	1 lb 6.2 oz
40	3 lbs 1.1 oz	2 lbs 0.8 oz
50	4 lbs 6.5 oz	2 lbs 14.9 oz
60	6 lbs 3.1 oz	4 lbs 2.2 oz
70	8 lbs 10.3 oz	5 lbs 12.2 oz
75	10 lbs 1.8 oz	6 lbs 12.0 oz
80	11 lbs 13.3 oz	7 lbs 14.3 oz

doors before dryness inside the factory starts to create problems such as product deterioration, product and raw material weight loss, fire hazard, dust, increased absenteeism due to illness, and troubles originating from static electricity.

Table 2 shows the weight of water in 10,000 cubic feet of air at 75 percent and 50 percent relative humidity at various temperatures. Notice that 10,000 cubic feet of air at 0 F and 75 percent relative humidity holds only 8 ounces of water. In order for the 10,000 cubic feet of air at 70 F to have a relative humidity of 50 percent, it must hold approximately 5¾ pounds of water. Assume that a complete change of air is to be made. If outside air at 0 F and 75 percent relative humidity is brought indoors and heated to 70 F, 5¼ pounds of water must be added to a 10,000 cubic feet room to bring the relative humidity indoors up to 50 percent.

Air doesn't just stay put in a room. A typical condition involves two complete air changes per hour. This means that five pounds (two and one half quarts) of water must be added for each air change—or more than one gallon per hour in this example.

One way to lick dry air problems would be to put pails of water around the room, hang up wet cloths, or drill perforations in steam pipes. However, these methods can be worse than none at all because they offer no control over the amount of moisture being added to the air. Relative humidity would vary greatly—which can be worse than uniformly low humidity. Table 3 shows the temperatures and relative humidities applicable to industrial air conditioning in several major industries.

Causes of static

Static electricity is caused by the sudden separation of two bodies in contact, such as belts moving away from pulleys, people walking across floors, dust particles blowing through pipes, paper going through printing presses, and rubbing operations. Sparks from static are dangerous in the presence of explosive gases, dusts, and volatile liquids such as are found in munitions plants, rubber cement houses, paint spray booths, and flour mills. Humidification is one good means of overcoming static.

When relative humidity is sufficiently high (at least 50 percent), a thin film of moisture is deposited on all surfaces in the room. The presence of normal impurities makes this moisture film a conductor that carries static electricity harmlessly to ground.

Dust formation

Dry air creates dust by causing fibers to become brittle, break off, and float away in the air. Dirt and foreign matter when dry are light and fine, and are more easily stirred up and kept suspended in the air. The addition of moisture to the air not only decreases dust formation, but also helps the dust to settle out.

Dry air removes moisture from the nasal passages and throat, making them more susceptible to airborne germs. Research indicates that some types of airborne bacteria including certain pneumonia germs will survive for weeks or months when relative humidities are 45 percent or less. At 50 percent relative humidity, these same bacteria die quickly. Most people feel chilly at 70 F indoors when relative humidity is down around 20 percent as is common in winter. A relative humidity of around 40 percent with room temperatures at 70 F is recommended as ideal.

Use steam humidifiers

The American Coating Mills, Elkhart, Ind. were having a great deal of trouble with the curling of paper sheets before clay coating.

TABLE 3 — TEMPERATURES AND RELATIVE HUMIDITIES APPLICABLE TO INDUSTRIAL AIR CONDITIONING*

Process	Temp. °F.	% R.H.
BAKERY		
Mixer (bread dough)	75-80	40-50
Fermenting	75-80	70-75
Proof box	92-96	80-85
Make-up room	75-80	65-70
Cake mixing	70-75	65
Crackers and biscuits	60-65	50
Wrapping	60-65	60-65
Dried ingredients storage	70	55-65
Fresh ingredients storage	30-45	80-85
Flour storage	65-80	50-65
Shortening storage (depending on type)	45-70	55-65
Sugar storage	80	35
Wax paper storage	70-80	40-50
BANANAS		
Ripening	68	90-95
Storage	60	85-90
CANDY (CHOCOLATE)		
Candy centers for coating	80-85	40-50
Hand dipping room	60-65	50-55
Enrober room	75-80	55-60
Panned specialty room	70-75	45
General candy storage	65-70	40-50
CANDY (HARD)		
Manufacturing	75-80	30-40
Mixing and cooling	75-80	40-45
Packing	65-75	40-45
Storage	65-75	45-50
CERAMICS		
Refractory	110-150	50-90
Molding room	80	60-70
Clay storage	60-80	35-65
Decalcomania production	75-80	48
Decorating room	75-80	48
CEREAL		
Packaging	75-80	45-50
LEATHER		
Drying:		
Vegetable tanned	70	75
Chrome tanned	120	45
Storage	50-60	40-60
LIBRARIES AND MUSEUMS		
Museum	70-80	40-50
Book storage	70-80	40-50
MUSHROOMS		
Storage	32-35	80-85
PAINT APPLICATION		
Lacquers — air drying	70-90	60
Oil Paints — air drying	60-90	60
PLASTICS		
Cellophane wrapping	75-80	45-65
PRINTING		
Pressroom		
Multicolor offset lithography	75-80	46-48
Other sheet-fed printing	75-80	45-50
Newspaper and other web printing	75-80	50-55
Stock room		
Multicolor offset lithography	73-80	5-8% above pressroom
Other paper storage	70-80	same as pressroom
Binding, cutting, drying, folding and gluing	70-80	45-50
Roll storage	73-80	50
TEXTILES		
Cotton-picking	75	55-60
Woolens		
Pickers	80-85	60
Carding	80-85	65-70
Spinning	80-85	50-60
Dressing	75-80	60
Weaving light goods	80-85	60
Silk		
Preparatory	80	60-65
Weaving	80	60-70
Dressing	80	60-65
Spinning	80	65-70
Throwing	80	60
Nylon		
Preparatory	80	50-60
Weaving	80	50-60
TOBACCO		
Cigar and Cigarette making	70-75	55-65
Softening	90	85-90
Stemming and stripping	75-85	70-75
Packing and shipping	74-76	65
Filler tobacco casing and conditioning	75	75
Filler tobacco storage and preparation	78	70
Wrapper tobacco storage and conditioning	75	75

* Abstracted by permission from HEATING, VENTILATING, AIR CONDITIONING GUIDE 1954, Chapter 45, pages 978-988.

They installed eight steam humidifiers with a total capacity of 1000 pounds per hour. As a result, they are saving considerable time formerly lost because the curling slowed down their printing and creasing operations. Steam dehumidification at the Eagle Ottowa Leather Tannery, Grand Haven, Mich. has reduced electrostatic stress and eliminated static—a serious hazard when swabbing leather with naphtha.

Furniture plants are eliminating 10 to 20 percent stock loss due to warping and checking caused by dry air. Users of wooden barrels can eliminate wood shrinkage and loosening of hoops in the barrel storage room by proper humidification. Brown & Bigelow's printing plant, St. Paul, Minn. has minimized trouble from paper curling shrinkage and has reduced color register difficulties by controlled humidification. A food processing plant reports that daily paper bag breakage has dropped from 500 to 10 since relative humidity in the bag storage room has been kept at a constant 60 percent. Meat processing plants are finding that steam humidification pays off since it eliminates weight loss and reduction in quality caused by the meat giving up large quantities of moisture to the dry air in cold storage rooms. (And raising the humidity in the cold storage room from 80 percent to 90 percent at 35 F, steam at 2.3 psig and 219 F raises the room temperature only 1/7 of one degree.)

Operating difficulties with electronic calculating machines have been overcome by elimination of static with humidification.

The Behr-Manning Corporation,

Steam humidifiers are installed at regular intervals along insulated steam line. The humidifiers are electrically controlled and operated by air.

manufacturers of glue-bonded abrasives, recommend that glue-bonded products should be stored in rooms with relative humidity over 35 percent if the temperatures are in the 60 to 70 F range. Low humidities affect glue-bonded products in two ways. A film of glue that has been in contact with air at a low humidity for some time becomes dry, more brittle, and weaker than it would if it had been stored under conditions that would retain its normal moisture content. The speed of deterioration increases as the relative humidity goes down. Although constant low humidity is extremely harmful, "cycling" of the product makes the condition even more serious. ("Cycling" is the alternate increasing and decreasing of the moisture content of the glue film because of exposure to alternating low and high humidities).

On an average, steam for humidification costs about two cents per thousand cubic feet of space per day. The equipment is of simple construction so that very little maintenance is required. Table 4 shows the amount of steam required per thousand cubic feet of space for humidification at 70 F.

Although the installation of steam humidification equipment is relatively simple, it does require some planning. Now is the time to be thinking about it, if you are going to be ready for next winter's heating season.

TABLE 4 — STEAM REQUIRED FOR HUMIDIFICATION AT 70 F

Pounds of steam per hour required per 1000 cubic feet of space to secure desired indoor relative humidity at 70 F, with various outdoor temperatures, assuming two air changes per hour and outdoor relative humidity of 75 percent.

Outd'r Temp.	Relative Humidity Desired Indoors														
	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
50 F				.045	.155	.271	.386	.501	.616	.731	.846	.961	1.076	1.191	1.306
40 F		.077	.192	.307	.422	.537	.652	.767	.882	1.000	1.112	1.228	1.343	1.458	1.573
30 F	.158	.273	.388	.503	.619	.734	.849	.964	1.079	1.194	1.309	1.424	1.539	1.654	1.769
20 F	.309	.424	.539	.654	.770	.885	.999	1.115	1.230	1.345	1.460	1.575	1.690	1.805	1.920
10 F	.409	.524	.639	.754	.869	.985	1.099	1.215	1.330	1.445	1.560	1.675	1.790	1.905	2.020
0 F	.474	.589	.704	.819	.934	1.049	1.164	1.279	1.394	1.509	1.625	1.740	1.854	1.970	2.085
—10 F	.514	.629	.744	.860	.975	1.090	1.205	1.320	1.435	1.550	1.665	1.780	1.895	2.010	2.125
—20 F	.540	.655	.770	.885	1.000	1.115	1.230	1.345	1.460	1.575	1.639	1.805	1.921	2.036	2.150

AIEE summer meeting

. . . starts on page 58

and readily maintained. Outstanding in the new design are the mechanical features . . . . in each of the following subjects: mounting base, contact structure, arc chute, operating mechanism, and tripping units. . . .

"The design of the positive action wiping contacts has eliminated current-carrying shunts and has provided improved blow-on contacts. The simplified arc chute construction provides smaller space requirements. The design of the three trip elements into the overcurrent trip unit has extended the scope of the breaker application. The adaptation of the positive displacement, silicone-oil, time-delay device provides consistent, accurate timing characteristics of the overcurrent trip units. The reduction in breaker frame size has expanded the scope of application of this breaker beyond the previous three-high to include the four-high, 90-inch cubicle structure."

Functional life-expectancy tests for liquid-filled transformers

A. M. Lockie
Westinghouse Electric Corporation

"Probably the best-known and most widely used information concerning the relationship of life expectancy and loading is that contained in the 'American Standard Guide for Loading Oil-Immersed Distribution and Power Transformers.' This document has been valuable in stimulating more economic utilization of transformers, but is limited in usefulness in several ways:

"(1) The underlying aging data are based on the effect of temperature on the tensile strength of cellulose in oil. Consequently they have limited significance for structures containing other materials. Furthermore, there is now some evidence that tensile strength is not an adequate measure of insulation quality in all applications.

"(2) It is assumed that a given amount of temperature exposure has the same effect on the life expectancy of all transformers. This makes no allowance for the skill of the manufacturer in using materials or in designing for minimum stresses in the insulation.

"(3) The arbitrarily selected endpoint of life (approximately 80 percent of the initial tensile strength) has no correlation with the ability of the transformer to continue in service.

"Not all of the factors affecting life expectancy are known, nor are all of the mechanisms of failure clearly understood. In general, however, the following will be significant:

"(1) Materials used. Of predominant importance are the initial thermal, electrical, and mechanical properties of the various materials. It should be noted, however, that the relative importance of these properties depends on the function performed by the particular material. Furthermore, various materials lose their initial properties at different rates, and the same material may lose various properties at different rates, during the aging process.

"(2) Design stresses. These may be thermal, electrical, or mechanical in nature. Their relative importance will be determined, not only by the nature and amount of material used, but also by the skill of the designer in keeping stresses to a minimum commensurate with economical use of the materials.

"(3) Duty. This includes not only the normal load cycle on the apparatus but also such environmental factors as ambient temperature and exposure to abnormal currents and voltages.

"(4) Permissible deterioration. Deterioration to complete destruction of the apparatus will seldom be acceptable. The degree which can be tolerated will be determined largely by safety and service-continuity requirements, and by the probability of incidence of abnormal operating conditions. . . .

"Heavier loading . . . . offers substantial operating economies, but it seems unwise to increase loading substantially without a realistic appraisal of its probable effect on life expectancy. Similarly, the development of new insulating systems offers substantial potential economies, but the extent of these ecomomies cannot be learned until the relative life expectancy of the new systems, as incorporated in the complete apparatus, is determined."

High power factor in dry-type transformers

G. A. Monito
L. B. Rademacher
Westinghouse Electric Corporation

"Insulation dissipation factor measurement, commonly referred to as power factor, has become increasingly important to manufacturers and users of transformers as a simple, non-destructive means of judging insulation condition. Through proper interpretation of this measurement, manufacturers control the quality of insulation, and users watch the performance of that insulation in service.

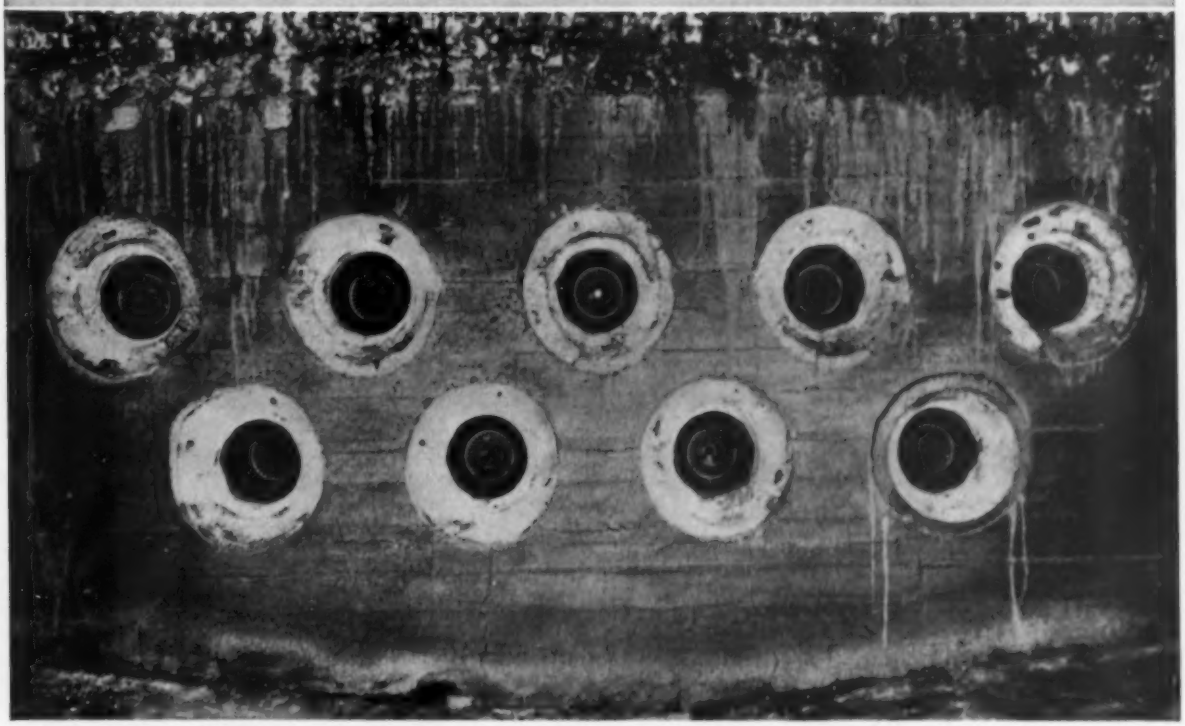
"Very little information is available on [power factor testing of] dry-type transformers. This lack of information, coupled with the present emphasis on power factor measurement, has led many transformer users to expect dry-type transformer power factors to be as low as those of liquid-immersed units. When these low power factors are not forthcoming, there is usually a great deal of unwarranted concern.

"This concern is unwarranted because dry-type transformers inherently do have higher power factors than liquid-immersed units. In most cases, these higher power factors are not detrimental to the operation or the life of the transformers in any way. . . .

"Power factors of dry-type transformers are inherently higher than those of oil-insulated units of the same rating because of the type, amount, and location of the insulating materials used in this construction. The normal power factor of dry-type transformers, which may be relatively high, has no effect on

Longer-lasting boiler wall quickly made with...

REFRACTORY CONCRETE



BURNER WALL in excellent condition after a year of service in a 150,000 lb./hr. steam boiler at station "B," San Diego Gas and Electric Company. This monolithic refractory concrete burner wall is made with TASIL HYDROCAST #401, a 3000°F. castable refractory manufactured by Charles Taylor Sons, Cincinnati, Ohio.

YOU MIGHT EXPECT this front wall to be ready for replacement. Over a year old, it has already outlasted previous burner walls on a 150,000-lb.-per-hour steam generator. But it is made of Refractory Concrete, and it's in such good condition that the form marks are still clearly defined.

Long service like this is typical of Lumnite* Refractory Concrete. Its low volume change and ability to take over 2600°F. heat result in maintenance economies. And consider the other savings:

Less time and labor are needed because Refractory Concrete is placed easily as a monolithic unit... reaches service strength within 24 hours. Special shapes can be cast on demand so inventories of special shapes are reduced. For instance, burner ports here are cast with the base—no special shapes and complicated fitting needed.

You'll find Refractory Concrete excellent for use wherever heat, corrosion or abrasion is a problem. It is readily made with Lumnite calcium-aluminate cement and refractory aggregates.

FOR CONVENIENCE, use a prepared castable mix such as the one that was used on the job shown above. Most castables are Lumnite Cement plus aggregates selected for specific temperature and insulation service – add only water. They're made and distributed by leading manufacturers of refractories. For more information, write Lumnite Bureau, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, New York.

**"LUMNITE" is the registered trade-mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.*

IP-L-98

ATLAS® **LUMNITE for INDUSTRIAL CONCRETES**

REFRACTORY, INSULATING, OVERNIGHT, CORROSION-RESISTANT

A UNIVERSAL ATLAS PRODUCT

UNITED STATES STEEL HOUR—Televised alternate weeks—See your newspaper for time and station

Circle 139 on READ-N-CIRCLE card for more data

either the operation or the life of the transformer.

In most cases minor irregularities are the cause of abnormally high power factors in dry-type transformers. In some cases, abnormally high power factors may indicate a threat to the operation and life of the transformer. Lowering the initial power factor will help to minimize the masking effect of an initially high power factor and may enable the user to detect early symptoms of trouble. A more complete understanding of the sources of high power factor has resulted in the use of improved insulating materials."

Selenium rectifiers for high temperature operation

G. O. Isaacson
Fansteel Metallurgical Corporation

"The development of the selenium rectifier has provided design engineers with a reliable, maintenance-free source of d-c power. However, certain inherent thermal characteristics of the device impose many limitations on its application. Normally, the operation of the rectifier in ambient temperatures above 45 C requires that the power output be derated to protect the unit or that additional equipment be provided for forced cooling. Operation at temperatures above 90 C severely reduces the life expectancies of the selenium cells in spite of the above precautionary measures.

"Recently, however, selenium cells have been developed which are capable of full-load operation at ambient temperatures up to 125 C. With a very slight current derating, the range of application is extended to 150 C. . . .

"Conservatively speaking, the high-temperature rectifier offers a life expectancy of more than 1000 hours of continuous operation at 100 C. As a matter of fact, some stacks have been in operation for more than 5000 hours. Life expectancies at 125 and 150 C will be in excess of 300 hours when the rectifier is operated at full current load. Since the reverse current properties remain stable at high temperatures, no voltage derating is necessary. With proper derating of the current load, cells operating at 125 and 150 C will have a comparatively long life."

What ethics?

Charles T. Chave
Ethics Committee, ECPD

"All engineers consider themselves ethical and moral. They would be indignant at any suggestion that they do not have ethics. . . .

"It appears that we have the problem [of engineering ethics] solved on paper since the Engineers Council for Professional Development has obtained endorsement of the Canons of Ethics for engineers by over 80 separate societies. These Canons took about 40 years to develop and were only adopted by ECPD in 1947. It would be an interesting experiment for each of you to ask one of your fellow engineers if he could state what is in these Canons or to ask if he has a copy of the Canons available for reference in his office. . . .

"Until individual engineers rather than engineering leaders become familiar with the Canons of Ethics, I don't think we can have much hope for a live consciousness of the specific ethical principles of engineering with which the profession should be concerned. . . . We are now in the position that more than 80 societies have subscribed to this code and that the average engineer hardly knows of its existence. . . .

"For engineers to be placed in the position to acquire knowledge greater than that of the average citizen confers upon them a special responsibility. Without morality and without ethics, they might conspire to use this knowledge to place themselves in a position of dictatorial power. Because of this threat, they might find themselves, instead, deprived of the responsibilities which are their professional right and reduced to a condition of clerkdom. We must as a group impress the general public with our trustworthiness, and the first way to do this is to take steps to develop a sense of ethics which becomes as familiar to the general public as the ethics of the medical profession."

Electrical insulation progress

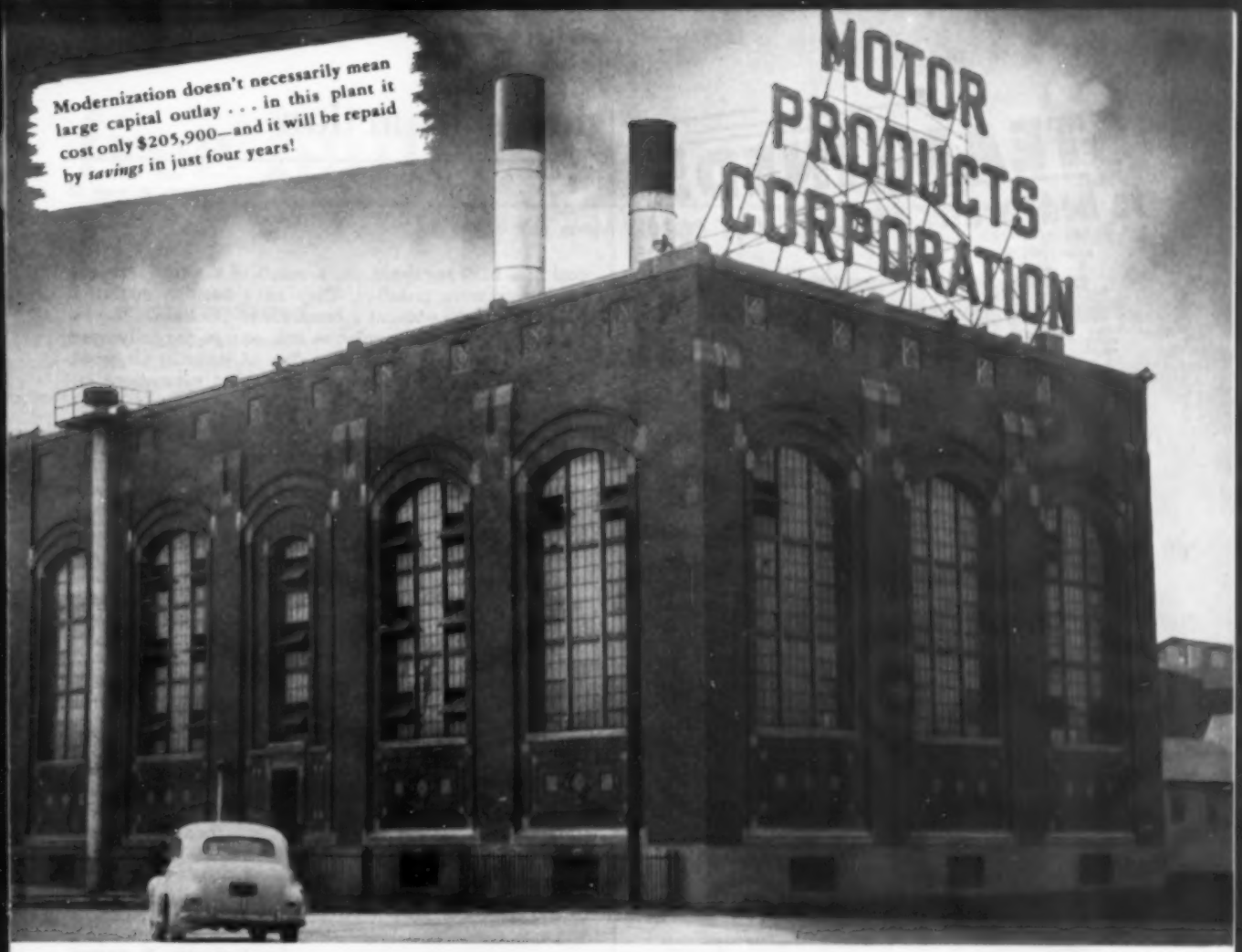
P. L. Alger
K. H. Mathes
General Electric Company

"It is concluded that insulating materials can no longer be classified in accordance with their chemical composition alone. Life testing of insulation will be used increasingly as a basis for temperature classification. It is believed that a general plan (whereby the committees responsible for the standards for each type of apparatus should develop or adopt their own test codes, and set their own temperature limits, for their own insulating materials and insulation systems) offers a practical way of making the needed change.

"It is necessary and proper that the long-established definitions of the temperature classes O, A, B, and H, should be continued in use for the interim period. . . .

"Normally, the required experience or test will be specified in terms of the life expectancy at a definite temperature, as established in accordance with Institute test codes. Of course, the meaning of thermal endurance will differ materially in the various standards. For example, a service life of a few thousand hours may be entirely satisfactory for equipment used in aircraft; whereas a life of 30 years or more may be normal for large power station equipment. Thus, the different standards may continue to allow a given class of materials to be used at quite different temperatures. . . .

"It is important to recognize that characteristics in addition to thermal endurance such as mechanical strength, moisture resistance, corona endurance, etc. are required for the successful use of insulating materials. The relative importance of these different characteristics varies in different applications. For example, in high-voltage equipment corona resistance and in traction equipment mechanical strength are most important. Such factors should not be allowed to confuse the overall temperature classification of materials but must be considered in determining the proper use of insulating materials and their thermal capabilities in reference to specific applications."


Modernization doesn't necessarily mean large capital outlay . . . in this plant it cost only $205,900—and it will be repaid by *savings* in just four years!
MOTOR PRODUCTS CORPORATION

Burning coal the modern way saves Motor Products $54,000 a year

Faced with poor boiler control, air pollution difficulties, inefficient coal and ash handling and other costly defects in its outmoded power system, Motor Products Corp., Detroit, called in local consultants to make a study. The engineers recommended a modernization program, involving some new equipment along with the adaption of existing units to new systems.

This modernization is saving Motor Products time, labor, and money—better than $54,000 per year. Now the entire operation is clean and efficient. Production of economical steam is faster, simpler, more reliable and well within the bounds of smoke and dust regulations.

Investigate Your Fuel Costs

If you're planning to modernize your plant or build a new one—or if you are just interested in cutting fuel costs—find out how coal, burned the modern way, compares to other fuels. Why not talk to a consulting engineer or your nearest coal distributor? Their advice may save you thousands of dollars each year.

facts you should know about coal

Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar.

Automatic coal and ash handling systems can result in a virtually labor-free plant.

Coal is the safest fuel to store and use. No dust or smoke problems when coal is burned with modern equipment.

In most industrial areas, bituminous coal is the lowest-cost fuel available.

Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

NATIONAL COAL ASSOCIATION
Southern Building, Washington 5, D.C.

Circle 120 on READ-N-CIRCLE card for more data

STEAMLINED!
to heat water fast, at low cost

In the Johnson Heater, water to be heated is routed first inside, then outside, a blanket of live steam. It's full pressure steam, too; up to 150 lbs., or 250 lbs. in heavy duty types, no reducers are needed. The result: faster, more efficient heat transfer for a unit of its size. No wonder industry has found so many applications for the Johnson "Instant" Heater, in heating water and process liquids of various types.

Sizes for all needs; write for literature

The Johnson Corporation
807 Wood St., Three Rivers, Mich.

Circle 130 on READ-N-CIRCLE card for more data

Size-marked for quick identification in 42 stock sizes

And these precision-machined solid steel collars stay put because they are held in place on the shaft by the famous UNBRAKO Self-Locking Socket Set Screw. Authorized industrial distributors carry complete stocks in sizes from 3/16" to 3" inclusive. Write for Bulletin 868. STANDARD PRESSED STEEL CO., Jenkintown 39, Pa.

HALLOWELL POWER TRANSMISSION DIVISION
SPS
JENKINTOWN PENNSYLVANIA

Circle 123 on READ-N-CIRCLE card for more data

ideas in action

. . . starts on page 28

cost of a $130 regulator. As a result of the test, 44 more regulators were installed. They have been in operation over six months without a breakdown. Should the device fail in any way, the regulators will stay in the fully open position to ensure a protective flow of water at all times. This permits installations in unattended substations.

Retractable walls control noise

Tests conducted in a foundry chipping department showed a reduction of 15 decibels from a starting noise level of 104 decibels, with the use of TransWall curtain, a product of the Bemis Bro. Bag Co. All readings were taken at a distance of six feet from the chipping hammer. The figures represent a change from a noise level that may have serious implications for worker comfort in the area, to one that is believed to be safe in all frequencies of the noise spectrum.

The lightweight sound barrier material possesses sufficient resistance to the passage of sound to make its use feasible. It has other qualities not possessed by permanent barriers, such as retractability, ease of installation, and movability. Because the curtains are retractable, they can be readily opened for materials movement or for complete accessibility to a machine or process.

coming events

. . . for industry & power

Aug. 15-19	AIEE Pacific General Meeting	Butte, Montana
Sept. 12-16	ASME and Instrument Society of America Annual Conference and Exhibit	Shrine Exposition Hall Los Angeles
Sept. 26-30	Atomic Industrial Trade Fair	Sheraton-Park Hotel Washington, D. C.
Sept. 27-29	Electrical Progress Show	Convention Hall Philadelphia
Oct. 3-7	AIEE Fall General Meeting	Morrison Hotel Chicago
Oct. 10-12	American Society of Lubrication Engineers Lubrication Conference	Antlers Hotel Indianapolis
Oct. 12-15	Eighth National Chemical Exposition	Coliseum Chicago
Oct. 19-20	ASME Joint Fuels Conference	Neil House Columbus, Ohio
Nov. 13-18	ASME Annual Meeting	Congress Hotel Chicago
Nov. 14-18	Exposition of Power and Mechanical Engineering	Coliseum Chicago
Nov. 14-17	Second International Automation Exposition and Exhibition	Navy Pier Chicago
Nov. 27-30	American Institute of Chemical Engineers Regular Annual Meeting	Statler Hotel Detroit

free bulletins

. . . just circle key numbers on READ-N-CIRCLE card on page 75

Air cleaning equipment

500-Dust collection manual

"The Collection and Recovery of Industrial Dusts," 32-page manual 101, discusses various types of dust and techniques used in analysis, lists the factors that influence choice of equipment. Buell Engineering Co., Inc.

501-Improved electrostatic dust control

"Dust and Fume Control," 11-page bulletin G406, tells of the improvements and refinements that have been made in electrostatic precipitation since the first Cottrell precipitator was erected. Also included are background material and illustrations of the Multiclone mechanical dust collector, the CMP unit—a combination Multiclone and Cottrell unit, the Dualaire dust collector, and Holo-Flite processor. Western Precipitation Corp.

502-Dust collectors and arresters

Series of four folders describes cyclone type collectors and portable, standard, and automatic bag-type dust arresters. Also includes 32-page catalog describing exhaust fans for dust collecting and air handling. Northern Blower Co.

504-Using dust collectors

Dust collectors, including cyclone, wet or dry dynamic, and cloth screen arrester types are the subject of a 32-page bulletin. Uses of air conditioning, ventilating, conveying, drying, and cooling units are presented. Kirk & Blum Mfg. Co.

Air handling equipment

506-Compressors for heavy duty

Bulletin L-675-B1B describes belt-driven and direct-connected motor-driven compressors in detail. These horizontal duplex-type compressors operate at moderate speeds for heavy-duty continuous service. Exclusive Feather Valves are discussed. 36 pages. Worthington Corp.

507-Industrial fan selection guide

Engineers and designers interested in quick, accurate selection of industrial fans for required capacities will find 27-page Bulletin EX-531 a useful, timesaving tool. The catalog introduces the type EX medium speed, industrial fan, for air and materials handling. Bayley Blower Co.

508-Suppressor problem solution

All metal, all welded surge suppressors are described in Bulletin 20-2. An example problem and its solution are also worked out. Four pages. Magnilastic Division, Cook Electric Company.

510-Are you wasting air?

"A Better Air Power System," Folder 213A points out that power losses in compressed air lines are frequently as high as 30 to 50 percent. It describes just how to go about finding out if more air is being wasted than the repair and renovation of the distribution system would cost. Six pages. Ingersoll-Rand Co.

Boilers and boiler accessories

512-Blowoff heat is free heat

Recover practically all of the heat of the blowoff water in a continuous blowoff system. Bulletin 5700 uses diagrams and text to explain how this steam may be used to heat feedwater in an open or deaerating heater and how it may be condensed in a closed heater or flash condenser to heat feedwater at a point in the system beyond the deaerating heater. Cochrane Corp.

513-Handbook on boiler startup

Handbook covers washing out new boiler, putting it in operation, handling in service, firing methods, and shut down. Includes big section of everyday engineering data. 48 pages. Titusville Iron Works Co.

514-Steam cost calculator

Made of heavy board, this Steam Cost Calculator will enable you to read directly cost of steam per hp for installations using oil, coal, or gas. It also gives a direct reading of efficiency of the system. Hapman Dutton Co.

516-Packaged medium boilers specs

The principal features of design and performance of compact, medium-pressure, packaged boilers are presented with sketches and engineering specifications in Bulletin P-391. Also included is a section on controls and an oil pump, heater, and strainer unit. Sixteen pages. Combustion Engineering, Inc.

518-Do your own boiler survey

Here's how to get a boiler survey form without obligation. Write for this bulletin covering the new CB self-contained boiler. Illustrations of installations, cutaway views of the boiler, and articles on how the units have proved themselves in specific applications are included. Four pages. Cleaver-Brooks Co.

519-Need steam in a hurry?

The advantages of completely assembled fast steaming boilers are discussed in Bulletin 1220. Available in sizes to 500 hp and pressures to 250 psi. Includes engineering data. Four pages. Orr & Sembower, Inc.

520-Package boiler improvements

Seven-page Bulletin AXY-1 gives full operating details and describes changes that have been made in the Amesteam generator, which is factory assembled, for 15 through 200 psi pressures. Ames Iron Works, Inc.

521-Answers to hot water problems

Answers to your hot water problems are given in booklet "Methods and Means." Operation and advantages of the instantaneous water heater as compared to the indirect method heater are discussed and illustrated. Pick Manufacturing Co.

525-Water tube boiler features

Water tube package boilers, known as the Compak line, are described in seven-page Booklet 5000. Design and construction features are shown in cut away drawings with a list of standard equipment, optional equipment, and a graph of performance curves. International Boiler Works Co.

527-Blowdown control chart

Determination of the rate of boiler blowdown and selection of a correctly sized heat exchanger are made possible with use of simplified Chart JPC, based on total dissolved solids in boiler water. Also given are several recommendations for selection of proper blowdown equipment in accordance with normal operating conditions of the boiler installation. Henszey Co.

529-Boiler baffle data

More than 30 boiler-setting plans are shown, with an analysis of how each arrangement of tubes is baffled to meet the specific boiler design in 20-page Bulletin BW-54. The Engineer Co.

530-Boilers for all uses

Fintube boilers and heat transfer products incorporating this company's 17

free bulletins

. . . starts on page 67

years of design experience in the chemical and petroleum industries are described in six-page Folder 542. BROWN FINTUBE CO.

531-Complete soot blower data

Bulletin 1137 gives complete information on the Model G9B blower which employs a fixed position rotating element to clean a large number of tubes by sweeping through a pre-determined arc. The bulletin suggests various uses. DIAMOND POWER SPECIALTY CORP.

Building, construction, maintenance

532-Roof drain manual

Prepared to aid in specification and installation of roof drains, 47-page "Zurn Roof Drain Manual" 54-1 includes engineering drawings showing types of drains to use for specific application. How to install drains in standard open deck parking areas and outdoor recreation terraces is also shown. J. A. ZURN MFG. CO.

533-Glass blocks save all ways

"How to Modernize Old Windows with PC Glass Blocks," seven-page Bulletin GB-104 points out that glass blocks have greater insulating value than sash windows, provide better daylighting, and are easier to clean and maintain. Drawings show how structural glass blocks will fit any existing window opening. PITTSBURGH CORNING CORP.

534-Steel shelves are adjustable

Photographs, cartoons, and text are used to point out the features of the new Hallowell Adjustable Steel Shelving in four-page Folder 2057. The open and closed type, the ledge type, and various combinations of swinging and sliding doors are featured. STANDARD PRESSED STEEL CO.

Corrosion control

538-Handy protective coating chart

Tables of properties, application techniques, and industrial uses are offered in Catalog 2-55-3M. Twelve pages. AMERCOAT CORPORATION.

539-Meet the film-forming amines

"Film Forming Corrosion Inhibitors Also Aid Heat Transfer," four-page Technical Paper No. 129, contains references to protection afforded by filming amines and attendant reduction in maintenance costs secured through protection against corrosion. W. H. & L. D. BETZ.

540-How to paint properly

This profusely illustrated Bulletin GET-677F includes a discussion of proper painting methods, preparation of paint, number of coats required, and tells how to repaint subway transformers. Eight pages. GENERAL ELECTRIC COMPANY.

Drafting methods and equipment

541-Simplify your drafting practices

Sample drawings of engineered parts and assemblies illustrate the eleven rules (from the use of word descriptions for simple parts to making freehand drawings wherever possible) for simplifying drafting practices. These simplified methods have shown that it is possible to cut the total number of hours required to complete a given volume of work by 40 to 50 percent. Thirty-six pages. AMERICAN MACHINE AND FOUNDRY COMPANY.

Engines: diesel, gas, steam

542-Will a diesel fill your needs?

DR Diesel Engines, as used in municipal power plants, water works, sewage treatment plants, and other industrial applications, are shown in eight-page Bulletin S-500-B52B. Rating chart gives information on 5 to 8 cylinder engines from 550 to 2200 hp. WORTHINGTON CORP.

FREE COPIES

For free copies of these handbooks, bulletins, and catalogs just circle the key numbers on the READ-N-CIRCLE card on page 75.

Electrical distribution

545-Conduit that beats corrosion

Test data show how specially protected heavy-duty rigid-steel electrical conduit stands up under corrosive attacks of salt spray, acid, alkali, and in other environments that have extreme moisture and heat conditions. A special baked-on coat of pigmented and plasticized vinyl chloride acetate copolymer, gives exceptionally high corrosion-resistance. NATIONAL ELECTRIC PRODUCTS CORPORATION.

546-Outdoor service equipment guide

Designed to make easier the selection of outdoor service equipment, 12-page Bulletin 2016 combines descriptive data on all available standard equipment—service entrance, receptacle type, dual control, three-phase units. HEINEMANN ELECTRIC CO.

548-New variable transformer ratings

Types 136 and 236 Powerstat Variable Transformers—design, new ratings, and performance—are discussed in eight-page Bulletin P354. THE SUPERIOR ELECTRIC CO.

549-How to choose circuit breakers

All essential information on the selection and application of molded case and large air circuit breakers is presented in this Speedfax catalog. Application sections make extensive use of charts and tables to explain selection of circuit breakers for motor circuits, bus duct, conductors, and transformer secondary applications. Also included are the latest prices, dimensions, and ordering instructions—arranged and indexed to reduce reference time and to help eliminate errors. Sixty pages. I-T-E CIRCUIT BREAKER COMPANY.

553-Dry transformer developments

"Latest Developments in Dry-Type Transformers," seven-page Catalog 153-A, presents the advantages of air-cooled units that are designed and constructed primarily for inside installations. SORGEL ELECTRIC CO.

554-Current-limiting fuse charts

Hi-Cap fuses for load protection above 600 amperes are described in six-page Bulletin HCS. Two handy charts are included: Current Limiting Effect and Opening Time Curves. Use of these fuses in conjunction with Fusetron fuses is explained. BUSSMANN MANUFACTURING CO.

555-How to select connectors

"How to Select and Use Today's Electrical Connectors," nine-page Technical News Letter 24, contains two articles on design of electrical connectors and their efficient application in modernizing industrial plants' electrical distribution systems. BURNDY ENGINEERING CO., INC.

556-Correct that low power factor

Booklet 50B, 27 pages, describes the Unit-Cell Box Type Capacitors which offer easy-to-install, economical means of correcting low power factor for large or small power consumers. SPRAGUE ELECTRIC CO.

Electrical utilization

557-Complete motor buying data

Complete buying information on standard a-c fractional and integral horsepower motors is presented in Bulletin GEC-1026. A special section on selection of integral horsepower motors covers lead requirements, enclosures, starting current limitations, speeds, motor types, and selection of fuses and circuit breakers. Information on all motors includes descriptions, specifications, and standard modifications. Twenty-eight pages, GENERAL ELECTRIC COMPANY.

558-More compact type H motors

Manufacturing developments and improved electrical characteristics make the new Type H motor more compact than previous models. Multicolor Bulletin 1856 shows cutaway views of the new Uniclosed motor. It points out that the new Type H conforms with new NEMA specifications. Twelve pages. U. S. ELECTRICAL MOTORS, INC.

559-Heat with electricity

Industrial electric heating applications and methods are described in 32-page Booklet, "101 Ways to Apply Electric Heat." Illustrated case histories show experience-tested ways to apply metal-sheathed Chromalox electric heating units in industrial jobs. EDWIN L. WIEGAND CO.

561-Handy pocket charts

Charts for wire gauge and temperature conversion are available in a pocket-size Bulletin No. GEZ-1510. The bulletin is printed on durable plastic material in large easy-to-read type. GENERAL ELECTRIC COMPANY.

Fuels and firing equipment

562-Fuel oil preheaters save $ $ $

Two-page Bulletin 54-79-1 explains how the use of the right fuel oil preheater can save costs by permitting use of lower grade fuel oil. Installation instructions, specifications, and capacities are listed for 2-pass and 6-pass preheaters. AMERICAN DISTRICT STEAM CO., INC.

563-Modern ways of burning coal

"Burning Bituminous Coal the Modern Way," contains 24 pages of case histories from industries of all sizes and types. Engineering survey results for equipment include annual fuel consumption and operating costs. BITUMINOUS COAL INSTITUTE.

564-Preassembled oil, gas burners

Advantages of preassembled oil, gas, and combination oil and gas burners are listed in eight-page Bulletin P-152. Units in sizes from 50 to 900 hp are listed for four common gas pressures and all grades of oil. COEN CO.

565-Burn refuse simply

Simple and effective method of firing refuse and cellulose fuels in a spreader stoker fired unit is discussed in Bulletin 5M-455. This pneumatic refuse fuel distributor has no moving parts and spreads a thin fuel bed for quick response to load changes. Eight pages. RILEY STOKER CORPORATION.

566-Refuse and wood burning

Engineering data concerning spreader stokers installed to burn refuse or wood are contained in 24-page Booklet 505. Stationary, manual dumping, power dumping, and traveling grate installations having maximum capacities from 10,000 to 275,000 pound steam per hour are described. DETROIT STOKER CO.

567-Handling heavy fuel oils

"The Heating and Handling of Residual Fuel Oils," Bulletin 1601, covers heavy fuel oils for use in burners of boilers, furnaces, and processing equipment of industrial plants. Use of Preferred Ribbon Heat for heating piping lines is explained. Eight pages. PREFERRED UTILITIES MFG. CORP.

568-Underfeed stokers explained

The latest refinements in single retort underfeed stokers are discussed in 12-page Catalog SB53. Both the fluid ram and gear drive units are described in detail by means of text, elevation drawings,

ALL STAINLESS INTERNALS eliminates corrosion of vital parts . . . specially designed to keep undeaerated water from contact with tank.

NO MOVING PARTS completely self-adjusting at all loads without springs or mechanical gadgets . . . no clogging or sticking . . . no maintenance problems.

Send for FREE Bulletin 102

L·A

L ★ A WATER SOFTENER COMPANY

1007 Air Way Glendale 1, California

Circle 148 on READ-N-CIRCLE card for more data

free bulletins

. . . starts on page 67

and cutaways. ERIE CITY IRON WORKS.

Heat exchangers

570-Heat exchange equipment specs

This 16-page bulletin gives all pertinent specification data for hot water storage heaters, instantaneous and converter heat exchangers, instantaneous and converter water heaters, and fuel oil heaters. PATTERSON-KELLEY CO., INC.

571-Heat exchanger operation

Air-flow diagram in two-page Data Sheet 124 graphically shows operation of the Aero Heat Exchanger for water, oil, or compressed air cooling. How the unit saves cooling water, piping, pumping, and equipment costs is explained. NIAGARA BLOWER CO.

Instrument and controls

573-Controls for gas firing

A factual and photographic roundup of how this company's Automatic Combustion Control systems are being used with various types of gas-fired boilers is presented in 14-page Bulletin MSA-116. This booklet gives basic information about the right kind of combustion control practices for gas-fired generators. HAGAN CORP.

575-Flow indication is valuable

Sight flow indicators that can be easily and inexpensively installed in any pipe line from ½ to 2 inch NPT are shown in Catalog Sheet 253. Two pages. JERGUSON GAGE & VALVE CO.

576-Automation dictionary

This "Automation Dictionary" covers some 87 words and phrases in the expanding vocabulary of automation. These are not standard engineering definitions but new engineering terms defined for the understanding of the average engineer. MINNEAPOLIS-HONEYWELL REGULATOR CO., INDUSTRIAL DIV.

577-Positive mercury switch controls

Positive controls for pressure, vacuum, temperature, liquid level, and other variables, equipped exclusively with sealed mercury switches are described in Bulletin 26/Me. Four pages. THE MERCOID CORP.

578-New combustion sampling

The full story of a newly developed sampling system for continuous trouble-free sampling and oxygen measurement of combustion processes is told in Bulletin 703. The equipment is designed for steam generating plants, rotary kilns and driers, open hearth furnaces, and tanks. ARNOLD O. BECKMAN CO., INC.

580-Temperature and pressure control

Through years of experience in instrument design and manufacture, this company has developed a specialized line of equipment for the recording and indicating of temperature and pressure. Seven-page Bulletin G-158-A shows typical examples. THE ELECTRIC AUTO-LITE CO., INSTRUMENT AND GAUGE DIV.

Lighting

582-Fluorescent lamp handbook

"Fluorescent Lamps and Auxiliary Equipments," eight-page Technical Bulletin LS-101, gives complete data on the Circline, general line, Slimline, and rapid start lamps. Wiring diagrams, equipment for each type of lamp, and equipment for suppression of radio interference are included. APPLICATION ENGINEERING DEPT., LAMP DIV., GENERAL ELECTRIC COMPANY.

Lubrication

583-Diesel lubrication revised

Written for everyone interested in the lubrication of diesels, "Lubrication of Diesel Engines," has been revised as Technical Bulletin B-1, 48 pages. It discusses diesel principles and design, types of engines in use, operating cycles, accessories and lubricant choice. SUN OIL CO.

Maintenance items

586-Repair leaks with cement

Text and illustration in this 48-page handbook present repair methods for leaks in pipes, boilers, radiators, concrete, cinderblocks, and sheet and plate metal. Directory describes 12 repair cements and jobs they will do. SMOOTH-ON MFG. CO.

Torque wrenches in wide range

Both inch-pound and foot-pound torquers are described in this complete 68-page Catalog. Types included are for a wide range of drive sizes with plain or ratchet head. *Please send requests directly to PROTO Tool Co., Dept. IP, 22762 Santa Fe Ave., Los Angeles 54, Calif., with 10¢.*

587-Quick reference for packing

Having trouble selecting the proper packing for a specific problem? This catalog outlines a complete line of rod and sheet packings, gasket cutters, and accessory items to meet almost every industrial requirement. Charts give quick reference material. Forty-eight pages. THE ALLPAX COMPANY, INC.

589-Rail spur maintenance handbook

Handbook D-3014 discusses maintenance of roadbeds, rails and joint bars. Discusses importance of ties, plates, and spikes. Sixteen pages. L. B. FOSTER CO.

590-Get up to date on welding

Things you should know about West-Ing-Arc, newest of all MIG welding processes are told in Bulletin B-6525. Physical properties of the welds, cost, and what this process can do for you are discussed. Eight pages. WESTINGHOUSE ELECTRIC CORP.

Materials handling (bulk)

591-Conveyor belt design chart

Engineering data for standard conveyor belt construction is shown in color on this chart for eight of the most popular ply and material combinations. It shows theoretical ultimate strength, actual ultimate strength, faster strength, operating strength with fasteners and with splice, and troughing index. A separate data sheet is included. QUAKER RUBBER CORP., DIV. OF H. K. PORTER CO., INC.

FREE COPIES

For free copies of these handbooks, bulletins, and catalogs just circle the key numbers on the READ-N-CIRCLE card on page 75.

593-Story of tile storage bins

"Vitrified Glazed Tile Industrial Storage Bins," four-page Bulletin 1153-B, tells you how this type of bin can keep materials clean, dry, and ready for use. Drawings show how the tiles are constructed and the simplicity of erecting silos made of these tiles. KALAMAZOO TANK AND SILO CO.

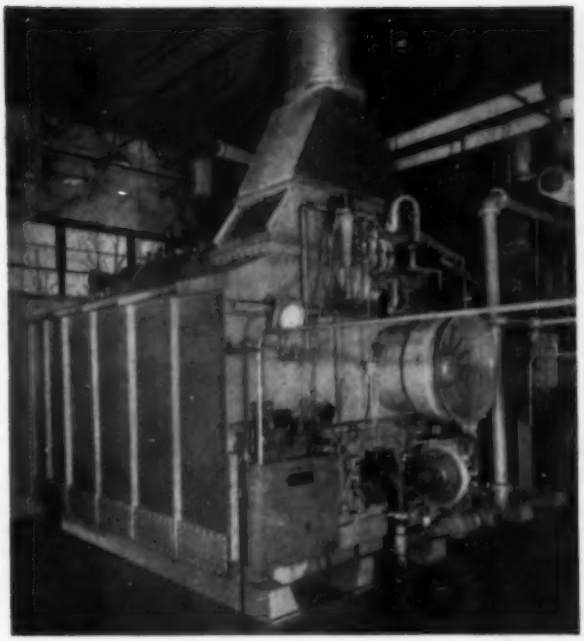
596-Pneumatic system principles

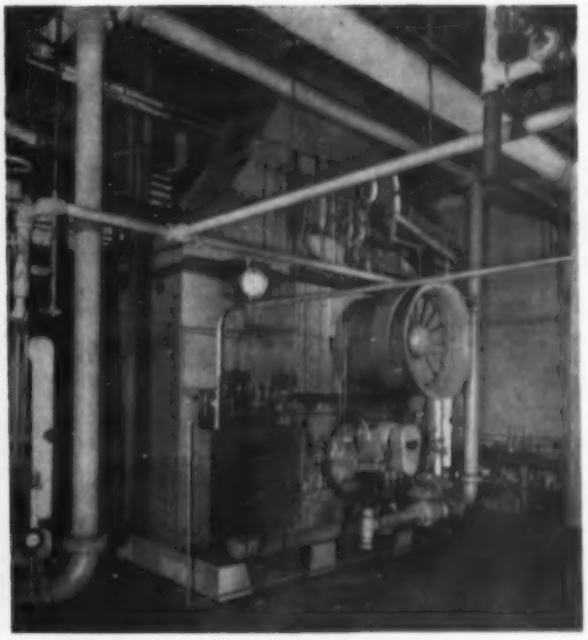
"Pneumatic Ash & Dust Handling Systems," seven-page Catalog 652, outlines general principles of pneumatic materials handling and explains how this company's products meet requirements for each application. ALLEN-SHERMAN-HOFF CO.

597-Belt conveyor design data

Engineering data required to design a a belt conveyor for any application are presented in 86-page Catalog 852. The booklet, published to serve as a handbook on conveyor design, states that many problems can be answered by using a standardized unit. THE JEFFREY MFG. CO.

(more free bulletins on page 72)





Union packaged boiler twins perform two key jobs for modern mid-west feed plant

Job Report (UIW)—Side by side in the Springfield, Missouri plant of Consolidated Products Company, two Union Type "MH" Packaged Steam Generators play a dual role in the manufacture of livestock and poultry feeds. They produce steam for processing milk by-products and for building heat.

Reported to "have proven very satisfactory and dependable sources of steam" by Consolidated, these packaged units were completely shop-assembled by Union Iron Works in Erie, Pa. before shipment to their midwest job site. Each of the pair has a steam capacity of 22,500 lbs. per hour and is equipped for burning heavy oil or gas.

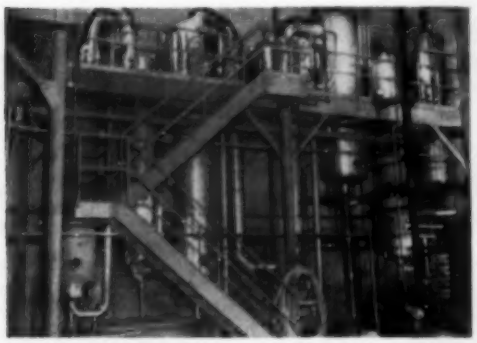
Stressing the selection of MH Steam Generators "on the basis of good design," Consolidated Products Co. adds, "Union Iron Works had previously given us excellent service on several coal-fired, water tube boilers."

From Oregon to Alabama, Union Type MH Steam Generators have been installed in breweries, chemical processing plants, pulp and paper mills, refineries, schools and institutions, to name but a few.

Patterned after larger but similar field erected Type H Boilers, originated by Union over 16 years ago, shop-assembled MH Units can be equipped to handle multitudes of needs formerly requiring costly field erection and special engineering. Superheaters can be installed to meet total temperature requirements, while both air heaters and economizers are readily supplied when needed.

Standard units are designed in 13 sizes from 10,000 to 40,000 lbs. of steam per hour at 250 psi, with higher pressures available for special applications.

The complete story on Union Type MH Steam Generators, including cut-away illustrations, tube layouts and dimension tables, can be obtained promptly by requesting Bulletin MH-353 from Union Iron Works, Erie, Pa.



VACUUM CONDENSING EQUIPMENT inside Springfield plant utilizes steam produced by MH Units to process milk by-products.

SPRINGFIELD BLENDING PLANT — One of 38 plants operated by Consolidated Products Co. to produce livestock and poultry feed.

Circle 105 on READ-N-CIRCLE card for more data

free bulletins

. . . starts on page 67

598-Bin level control redesigned
Changes in the design of the high duty Tellevel bin level control are explained in four-page Bulletin 110. The redesigned switch housing and deflector mechanism are shown in drawings as well as means of mounting unit for standard and special applications. Stephens-Adamson Mfg. Co.

599-Storage for bulk materials
If you handle flowable bulk materials such as ashes, coal, coke, sand or lime, or use cooling towers, dust bins, mixing tanks, stacks or well houses, read Bulletin 20-10-50-N. Twelve pages. The Neff & Fry Co.

FREE COPIES

For free copies of these handbooks, bulletins, and catalogs just circle the key numbers on the READ-N-CIRCLE card on page 75.

600-How to buy overhead cranes
"How to Select an Overhead Crane," seven-page Bulletin 79, is designed to help those who select and specify cranes to analyze handling problems, decide on type of crane desired, and draw up specification sheets for crane proposals. The Whiting Corp.

Piping, tubing and hose

602-Data on pipe fabrications
Specifications for all sizes of pipe from ⅛ to 24 inch diameter are presented in 16-page Catalog 575C. Tables give data and descriptions of standard, extra strong, and double extra heavy pipe, spiralweld pipe, large OD pipe, line pipe, electric-weld tubing, welding fittings and flanges, oil well casing, and water well casing. Facilities for fabricating structural pipe uses are discussed. L. B. Foster Co.

605-Stainless steel piping data
Engineers and designers concerned with problems involving stainless piping will find valuable data in six-page Bulletin TB-356. It outlines methods of bending and joining stainless pipe and discusses the problems of light wall versus heavy wall pipe with tables of dimensions and weights of various stainless pipe size schedules. The Babcock & Wilcox Co.

606-How to simplify piping
Swivel joints provide an ideal solution for piping connections to moving or movable machine parts. Catalog 265-B contains complete specifications, dimensions, and application data. Twelve pages. Barco Manufacturing Co.

Power transmission

608-Do's and don'ts for bearings
A helpful list of "do's" and "don'ts" to prolong bearing life appears in Bulletin 506. Also included is information on the storage and handling of lubricants. Four pages. New York and New Jersey Lubricant Co.

609-V-Belt rating manual
Multi-V-Drives—This 100-page master engineering manual presents a scientific and simplified method for rating V-Belts. In addition to accepted theories on V-drive engineering, factors such as small diameter sheaves, centrifugal force, average hours per day operation, and other conditions affecting belt lines have been considered. Worthington Corp.

610-Revised JIC hydraulic standards
Your personal copy of the JIC Hydraulic Standards for Industrial Equipment, including complete, unabridged revisions made at the January '53 meeting of the JIC is available. It is punched for insertion in standard catalog binders. Twenty pages. Miller Fluid Power Co.

611-Adjustable speed principles
Principle of operation and use of Dynamatic Eddy-Current adjustable speed equipment is described in 16-page bulletin GB-2. Torque and load curves are given. Dynamatic Div., Eaton Mfg. Corp.

612-Save power with lower speed
Darcova Pumcups, which permit equipment to be operated at reduced speeds, are described in two bulletins: No. 4502 on Pumcups for air or hydraulic mechanisms: and 4401 on units for reciprocating pumps. Darling Valve & Mfg. Co.

Pumping equipment

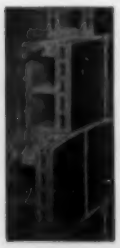
615-Automatic sump pump data
Complete engineering data on a line of sump pumps that covers every application is presented in Bulletin 5530. Submersible sump pumps, vertical pumps, and hydraulic operated drainers are discussed. Four pages. Penberthy Injector Company.

BREWERY
stores grain, malt, sugar in multiple

Kalamazoo

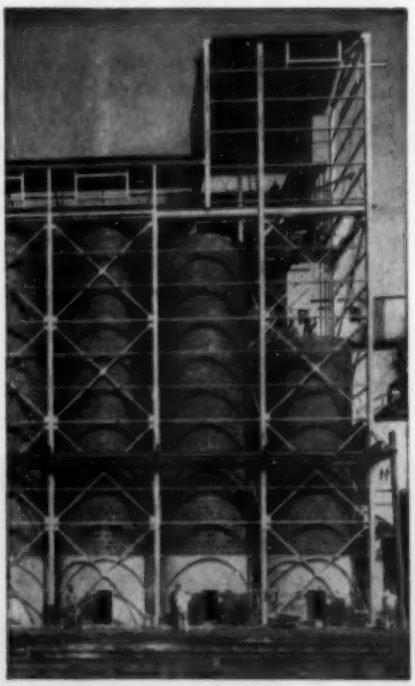
VITRIFIED GLAZED TILE INDUSTRIAL STORAGE SILOS

Here's another of the many industries using *Kalamazoo* storage silos. You, too, will get advantages unequalled by other bins or methods—materials protected from weather, contamination, fire, theft. *First* cost the *only* cost—no maintenance problems.



Corrosion-resistant vitrified glazed tile double-wall blocks made in *Kalamazoo's* own plant. Corrosion-proof mortar joints.

SEND FOR BULLETIN 1153-B TODAY



INDUSTRIAL STORAGE BIN DIVISION

Kalamazoo TANK and SILO COMPANY

841 HARRISON STREET . . . KALAMAZOO, MICHIGAN

Circle 132 on READ-N-CIRCLE card for more data

619-How to figure pump heads

How to determine total head against which pump must operate is only one of the valuable sections in 12-page Bulletin 353-1000 on the Bilton pump, a general purpose pump suitable for medium and low head service. BYRON JACKSON CO.

620-Sewage and sump pump selection

Comprehensive, eight-page Bulletin 325-A32 is for engineers, architects, and contractors who specify sewage and sump pumps. It describes in detail three types of pumps: The NKS Vertical Wet Pit Single or Duplex; the NKV Vertical Dry Pit; and the NKH Horizontal. AMERICAN-MARSH PUMPS, INC.

621-Double suction centrifugals

Eight-page Bulletin 105-B describes Aurora Type O horizontal split case, double suction centrifugal pumps which are recommended for municipal and industrial water supply or for handling circulating and wash water. AURORA PUMP DIV., NEW YORK AIR BRAKE CO.

Refractories and insulation

622-Handbook of boiler refractories

"Boiler Refractories," 20-page Bulletin R-36, has been designed to provide operators of stationary and marine boilers with an authoritative guide for selecting the most efficient and economical refractories for their boilers. BABCOCK & WILCOX CO., REFRACTORIES DIV.

623-Using sheet insulation

"Marinite For Driers, Ovens, Breechings, and Housings," 16-page booklet IN-153 A, tells you how you can build and insulate with this sheet material. Handling and working recommendations, data on physical and thermal properties, and construction and fabrication suggestions are given. JOHNS-MANVILLE.

624-Refractory concrete manual

"Refractory Concrete Manual," 16-pages, covers basic information on recommended practice for mixing and placing refractory concrete. Lumnite Div., UNIVERSAL ATLAS CEMENT CO.

625-Refractory construction

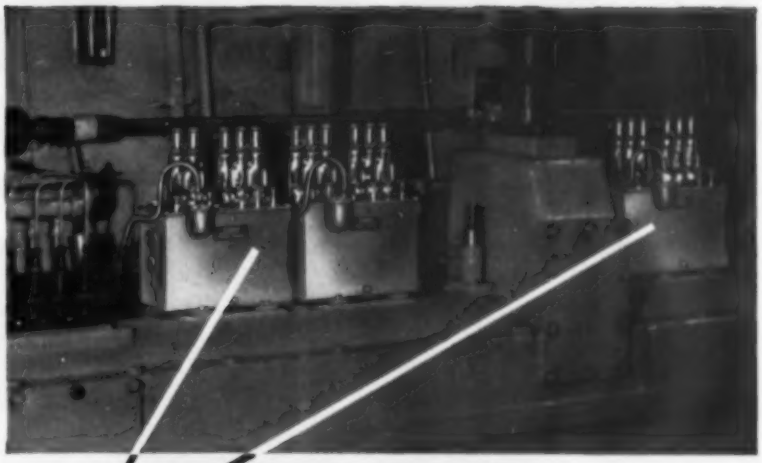
The different types of construction considered standard for industrial refractory are described in Bulletin 39. Profusely illustrated. Twenty pages. BIGELOW-LIPTAK CORP.

Refrigeration

626-Specifying refrigerant receivers

"Liquid Receivers for Ammonia and Freon," 4-page Bulletin LR-1, gives all the information necessary for specifying these units and includes elevation drawings to show typical installations. HENRY VOGT MACHINE CO.

(more free bulletins on page 78)



MANZEL

FORCE FEED LUBRICATORS Control Lubrication to Save Oil and Cut Production Losses

Outdated lubrication practices can waste half, or more, of all the lubricants you buy. Only the exact amounts needed — never more and never less — are used with Manzel Force Feed Lubricators. There's no waste!

And because Manzel Lubricators operate dependably and automatically without thought or attention, they save labor and the cost of unexpected breakdowns caused by faulty or neglected lubrication. They quickly pay for themselves and then keep on saving money through the years.

Can be built into new, or installed on existing equipment. On any question of how best to lubricate, always call or write Manzel.

SPECIAL QUALITY FEATURES OF MANZEL LUBRICATORS

- Completely protected with Parco Lubrite
- Rust resistant reservoirs
- Closer fitting plungers made possible by special precision equipment
- Gears of harder alloy for longer wear
- Every unit factory-tested before shipment

FOR CHEMICAL FEEDERS, TOO, CONSULT MANZEL

Professionally qualified engineering representatives throughout the country.

Manzel

DIVISION OF
HOUDAILLE-HERSHEY CORP.
320 BABCOCK ST., BUFFALO 10, N. Y.

Circle 128 on READ-N-CIRCLE card for more data

. . . for LOW COST STEAM TOMORROW

buy a SUPERIOR STEAM GENERATOR TODAY

Superior Steam Generators encompass the most complete line of packaged boilers available. Write for complete details today.
Fire Tube types to 600 b.h.p. (Write for Catalog 702 F).
Water Tube types to 45,000 lbs./hr. (Write for Catalog 702 W).

Man will reach the moon . . . tomorrow perhaps . . . but more than likely "tomorrow" in the dictionary of scientists means 20 years . . . and that's a long time to pay the penalty of high steam costs. A boiler is a long term investment; and the equipment you buy today determines your steam costs for years to come.

Superior Steam Generators are designed and built to last longer, and to operate at higher efficiencies throughout their entire serviceable life. Evidence of this you can see for yourself in Superior's bigger, heavier construction and completely integrated design. Superior Steam Generators provide more steam per dollar over a longer serviceable life.

for performance you can **BANK** *on*

SUPERIOR

STEAM GENERATORS

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

Circle 106 on READ-N-CIRCLE card for more data

Use a READ-N-CIRCLE card for FREE new product information, handbooks, bulletins, literature for your data file.

READ

this issue of Industry & Power

and

CIRCLE

the key numbers on the adjoining cards corresponding to the advertisements, new products, and literature items that interest you.

Drop the READ-N-CIRCLE card in the mail. No stamp is needed.

INDUSTRY & POWER'S Reader Service department will immediately forward your requests to the manufacturers, who will send directly to you the information you request.

---

handy guide

. . . to advertised products

Air cleaning equipment

BUELL ENGINEERING COMPANY. Here's a dust collector that has proved effective on *natural* and *forced* draft installations. New descriptive folder gives complete design and performance data.
Read page 81 and circle number 100.

PRAT-DANIEL CORPORATION. Control your industrial dusts and fly ash with engineered P-D Collector Systems. Reprint No. 102 will assist you in determining your requirements for dust and fly ash collectors.
Read page 17 and circle number 101.

Air conditioning, heating

RUPPRIGHT ROTARY ROOF COOLER. Here's an economical way to cool your building and reduce air conditioning costs. Easily

READ-N-CIRCLE Card for FREE information

Your name _____ Title _____

Company name _____

Company address _____

City _____ Zone _____ State _____

Please give company name above. If you wish delivery of free information at home, also fill in below.

Home address _____

City _____ Zone _____ State _____

100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124
125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149
150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174
400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424
425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449
450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474
475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499
500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524
525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549
550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574
575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599
600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624
625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649
700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724
725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749

INDUSTRY & POWER August, 1955 Card void after December 1, 1955

READ-N-CIRCLE Card for FREE information

Your name _____ Title _____

Company name _____

Company address _____

City _____ Zone _____ State _____

Please give company name above. If you wish delivery of free information at home, also fill in below.

Home address _____

City _____ Zone _____ State _____

100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124
125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149
150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174
400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424
425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449
450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474
475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499
500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524
525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549
550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574
575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599
600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624
625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649
700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724
725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749

INDUSTRY & POWER August, 1955 Card void after December 1, 1955

installed—can be used on any roof. Details will be sent to you on request.
Read page 82 and circle number 102.

Air handling equipment

ALLIS-CHALMERS. Get constant efficiency and air supply with *Ro-Flo* compressors. Rotary design cuts maintenance. Available in ratings from 250 to 1800 cfm.
Read page 93 and circle number 103.

Boilers and boiler accessories

THE TITUSVILLE IRON WORKS COMPANY, a Division of Struthers Wells. Outstanding performance is offered by the Titusville Scotch Marine power boilers. Long experience and large volume manufacture enable you to put confidence in Titusville. Bulletin B-3075A tells the complete story.
Read page 23 and circle number 104.

UNION IRON WORKS. Packaged boilers with flexibility of usage is the keynote of Union's "MH" line. These packaged steam generators offer the superiority of the Union design without costly field erection. Bulletin MH-353 gives complete data.
Read page 71 and circle number 105.

SUPERIOR COMBUSTION INDUSTRIES, INC. Superior's bigger, heavier construction assures longer life and higher efficiency. Catalog 702 describes complete line of boilers available.
Read page 74 and circle number 106.

INFILCO, INC. Your boiler feedwater problems can be solved by an Infilco engineer. Infilco offers engineered equipment for all types of water and waste processing. Submit your problems.
Read page 2 and circle number 107.

THE LIQUIDOMETER CORP. Liquids worth storing are worth measuring with a Liquidometer tank gauge.
Read page 30 and circle number 108.

YARNALL-WARING CO. Yarway remote liquid level indicators give you improved visibility of remote boiler water level readings. Approved for use under recent ASME boiler code committee ruling. Bulletin WG-1823 gives full information.
Read page 34 and circle number 109.

Building construction, maintenance

FLEXROCK COMPANY. Repair broken factory floors without tie-up. This tough concrete patch sets instantly. Mail coupon for free booklet.
Read page 92 and circle number 110.

Communications equipment

AUTOMATIC ELECTRIC SALES CORPORATION. Save manhours—get instant communication—install your own privately-owned PAX Business Telephone System. Write for an actual "on-the-job" case study.
Read page 9 and circle number 111.

Corrosion control

DEARBORN CHEMICAL COMPANY. If your steam lines are clogged and inside diameter of piping is reduced by scale, Dearborn offers the correct treatment to eliminate trouble. Mail the coupon for complete information.
Read page 3 and circle number 112.

Electrical distribution

HEINEMANN ELECTRIC COMPANY. *Safelets* protect your circuit wiring and equipment by interrupting short circuits or overloads instantly. Details in Bulletin 1010 can save you hours of downtime and dollars of equipment repair.
Read page 25 and circle number 113.

I-T-E CIRCUIT BREAKER COMPANY, SWITCH-

FIRST CLASS
PERMIT No. 19
(Sec. 34.9, P.L.&R.)
ST. JOSEPH, MICH.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

4¢ POSTAGE WILL BE PAID BY

INDUSTRY & POWER

COMMERCIAL BANK BLDG.

ST. JOSEPH, MICH.

FIRST CLASS
PERMIT No. 19
(Sec. 34.9, P.L.&R.)
ST. JOSEPH, MICH.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

4¢ POSTAGE WILL BE PAID BY

INDUSTRY & POWER

COMMERCIAL BANK BLDG.

ST. JOSEPH, MICH.

handy guide

. . . continued from preceding page

GEAR DIVISION. Protect your personnel and equipment with I-T-E Urelite air circuit breakers. Literature describes the complete line and advantages of I-T-E products.

Read page 15 and circle number 114.

SORGEL ELECTRIC COMPANY. Air-cooled dry-type transformers of proven quality and performance are available from Sorgel in a large variety of sizes and types. Details on request.

Read page 85 and circle number 115.

SPRAGUE ELECTRIC COMPANY, INDUSTRIAL CAPACITOR DIVISION. Sprague power factor capacitors can save you money. Write for free 28-page descriptive guide.

Read page 88 and circle number 116.

Fuels and firing equipment

THE CHESAPEAKE AND OHIO RAILWAY. There's a lot more to buying coal than considering the cost per ton. Want to solve your particular fuel requirements? Chesapeake and Ohio will be glad to help.

Read page 33 and circle number 117.

THE ENOS COAL MINING COMPANY. Dependability, prompt delivery, uniform sizes, and a life-time source of supply are offered by The Enos Coal Mining Company. Place a trial order and compare.

Read page 6 and circle number 118.

GENERAL COAL COMPANY. A variety of anthracites and bituminous coals are offered by General. Branches in leading cities.

Read page 32 and circle number 119.

NATIONAL COAL ASSOCIATION. If you are planning to modernize your plant or build a new one or if your are interested in cutting fuel costs, consider how the modern way of burning coal compares with other fuels. Write for information and case histories on how to save money by burning coal.

Read page 65 and circle number 120.

NATIONAL AIROIL BURNER. Fuel oil pumping and heating units will give you premium performance from your burners by delivering fuel oil at proper temperature and pressure. Bulletin 4C gives interesting and informative data on this company's years of experience.

Read page 16 and circle number 121.

PETRO. Convert your boiler to economical automatic firing with Petro—a complete firing system in a single package. Send coupon for details of low cost installation and operation.

Read page 87 and circle number 122.

Heat exchangers

THE JOHNSON CORPORATION. Faster, more effiicient heat transfer is offered by The Johnson "Instant" heater in heating water and process liquids. Literature describes sizes and applications.

Read page 66 and circle number 123.

NIAGARA BLOWER COMPANY. Niagara Aero heat exchanger cools water, oils, solutions, lubricants, and coolants. A closed system offers simple operation and long life. Bulletin 120 gives complete description.

Read page 20 and circle number 124.

Instruments and controls

THE ELECTRIC AUTO-LITE COMPANY, INSTRUMENT & GAUGE DIVISION. Model 1000 gives permanent temperature record. Available in various ranges and cycles. Remote reading optional. New catalog.

Read page 83 and circle number 125.

ERNST WATER COLUMN & GAGE CO. Order high-pressure gage glasses, from Ernst. Made in a variety of lengths and diameters. Send for catalog.

Read page 82 and circle number 126.

LIQUIDOMETER CORP. For gauging liquids of all kinds. One hundred percent automatic. Underwriters Laboratories approved. Write for complete details.

Read page 30 and circle number 108.

MANZEL, DIVISION OF HOUDAILLE-HERSHEY CORP. Save oil and cut production losses by controlled forced feed lubricators. Operates dependably and automatically with new or installed equipment. For lubrication advice call Manzel.

Read page 73 and circle number 128.

Maintenance items

SMOOTH-ON MANUFACTURING COMPANY. Quick, low-cost emergency repairs possible with Smooth-On. Applies easily, hardens quickly, makes a tight durable seal. Free repair handbook.

Read page 90 and circle number 129.

STANDARD PRESSED STEEL COMPANY, HALLOWELL POWER TRANSMISSION DIVISION. Solid steel collars that stay put. Held in place on the shaft by Unbrako set screws. Bulletin 868 describes complete stocks and uses.

Read page 66 and circle number 130.

THREAD-EZY MFG. COMPANY. Port-A-Pony pipe cutter cuts pipe right on the job in 30 seconds! Write for full information.

Read page 88 and circle number 131.

Materials handling (bulk)

KALAMAZOO TANK AND SILO COMPANY. Industrial storage silos have many uses. Vitrified glazed tile protects materials from weather, contamination. fire, and theft. No maintenance. Bulletin 1153-B shows advantages of silo storage.

Read page 72 and circle number 132.

Piping, tubing, and hose

HENRY VOGT MACHINE CO. Uniformity of structure, fine grain, and freedom from porosity make Vogt fittings corrosion resistant and enable them to withstand the shocks and stresses of high pressure and temperature. Catalog F9 will help you select and apply all fittings.

Read page 13 and circle number 133.

Power transmission

DYNAMATIC DIVISION, EATON MANUFACTURING COMPANY. Follow the modern method of adjustable speed control and testing. Bulletin GB2 describes and illustrates eddy-current units and their advantages.

Read page 27 and circle number 134.

Pumping equipment

AMERICAN-MARSH PUMPS. Eighty years' experience in building pumps is a plus value offered by American-Marsh. Each pump is individually tested. Bulletin 350 gives details. Write and describe your requirements.

Read page 83 and circle number 135.

AURORA PUMP DIVISION, THE NEW YORK AIR BRAKE COMPANY. A variety of pumps for all applications is manufactured by Aurora. High-temperature, turbine-type, centrifugal—what are your needs? Catalog "M" describes full line.

Read page 89 and circle number 136.

BYRON JACKSON CO. Now—B. J. mechanical seals for high-pressure boiler feed pumps! No operating adjustment, minimum of heat and liquid loss, simple maintenance. Send for proven performance data.

Read page 94 and circle number 137.

Lubrication

DARLING VALVE & MANUFACTURING CO. New 100 percent nylon composition pumcups give you unprecedented piston packing performance! Available only in Darcova Pumcups. Bulletin 5509 gives helpful data.

Read page 79 and circle number 138.

(more handy guide on page 78)

Refractories and insulation

LUMNITE BUREAU, UNIVERSAL ATLAS CEMENT COMPANY, subsidiary of U. S. Steel Corp. Lumnite refractory concrete for use wherever heat, corrosion, or abrasion is a problem. Write for more information showing durability of Lumnite.
Read page 63 and circle number 139.

Valves and regulators

THE CHAPMAN VALVE MANUFACTURING COMPANY. Rigid specifications are maintained in Chapman's steel valves. This assures smooth and dependable service. Catalog 20 describes the Chapman line of gates, globes and checks.
Read page 7 and circle number 140.

EVERLASTING VALVE COMPANY. Jacketed valves for free-flowing viscous materials. Descriptive bulletin and 60-day free trial is offered.
Read page 31 and circle number 141.

THE POWERS REGULATOR COMPANY. Accurate, automatic control of temperature, humidity, and pressure. Powers' engineers will help you.
Read page 8 and circle number 142.

Vibration and noise control

SPENCE ENGINEERING COMPANY, INC. Selecting a temperature regulator? Consider the accuracy, dependability, and ease of maintenance of Spence. Bulletin T500 will help you select an economical temperature regulator.
Read page 19 and circle number 143.

BURGESS-MANNING COMPANY. Stop that noise! Burgess-Manning snubbers are engineered to correct your specific noise problems from air, steam, and other gas discharges. Let our sound engineers recommend solution. No obligation.
Read page 89 and circle number 144.

Water supply and treament

AMERICAN WATER SOFTENER COMPANY, INC. Fifty years of engineering experience in water treatment has resulted in American Tray Deaerators designed for the best possible efficiency. Bulletin 402 describes the American method.
Read page 21 and circle number 145.

W. H. & L. D. BETZ. Completely integrated engineering on all water problems is offered by Betz. The Betz Consulting Division stands ready to solve your waste or water problems.
Read page 11 and circle number 146.

HUNGERFORD & TERRY, INC. A complete line of water conditioning systems is available from H&T. All sizes, all capacities, manual or automatic. Send for bulletin.
Read page 92 and circle number 147.

L * A WATER SOFTENER COMPANY. The new stainless steel deaerator eliminates corrosion. Free bulletin 102 describes the L * A deaerator which is completely self-adjusting.
Read page 69 and circle number 148.

RANNEY METHOD WATER SUPPLIES, INC. If you need an efficient, economical water supply, see Ranney. Clear, non-turbid water at lowest cost. Write for details.
Read page 29 and circle number 149.

free bulletins

. . . starts on page 67

Traps, strainers and separators

630-Sintered bronze filter data

Basic information on the advantages of porous bronze as a filtering medium and complete engineering data on bronze filters already in use on industrial applications are offered in this new bulletin. The company's free creative engineering service is also discussed. Sixteen pages. PERMANENT FILTER CORPORATION.

631-Traps fit all needs

Ball float traps for draining water from air, gas, or steam lines or for draining light liquids from gas under pressure are described in eight-page Bulletin 289. An orifice capacity chart and tables of maximum operating pressures help in selection. ARMSTRONG MACHINE WORKS.

632-Line-type separators

Circular 506 covers type 30N series, welded steel, line-type separators for steam, air, and gas. WRIGHT-AUSTIN CO.

Turbines

633-Speed control fundamentals

"Fundamentals of Turbine Speed Control," 32-page brochure H-21, is an educational piece intended to clarify the operation of common types of automatic speed control for steam turbines. Simplified diagrams illustrate operating principles of actual control systems. ELLIOTT CO.

634-How steam turbines work

For a clear picture of how single-stage steam turbines operate, you will want Bulletin 1954C. Information on availability of various frames for single-stage applications, details on variable speed governors, and other features are included. Eight pages. WORTHINGTON CORP.

635-Design of multi-stage turbines

Smaller framed, multi-stage turbines are featured in six-page bulletin. Overspeed governor, governor valves, blades, diaphragms, and other design features are discussed. TERRY STEAM TURBINE CO.

636-Turbine capacity curves

Bulletin T-54 shows several applications of dependable turbines, gives operating ranges and specifications. Includes capacity curves. Four pages. L. J. WING MFG. CO.

Valves and regulators

638-Combined temperature regulators

Temperature control by means of temperature regulators that combine both a pressure and thermal element is discussed in four-page folder 1006. Installation drawings point out how the Spence Type ET150 regulator can be used with an instantaneous water heater, a storage water heater, and a forced warm air heating system. SPENCE ENGINEERING CO., INC.

639-Valve and regulator data

Specifications and operational data for steam, gas, air, oil, and water regulating equipment are presented in 60-page Catalog 54. Illustrations and descriptions are included for pressure, temperature, and combination regulators, diaphragm, float, motor, solenoid, pop, and relief valves. O. C. KECKLEY CO.

640-Control valve reference book

Three basic types of single seated diaphragm control valves are discussed in 15-page Bulletin 5304. Cut-away views and charts with complete specification data make this a good reference book. LESLIE CO.

FREE COPIES

For free copies of these handbooks, bulletins, and catalogs just circle the key numbers on the READ-N-CIRCLE card on page 75.

644-Pressure valves for all ranges

Catalog 10 describes List 960 and 990 valves. The 960 is for a pressure range of 200 lb at 100 F to 380 lb at 1000 F. The 990 is for higher pressures. CHAPMAN VALVE MANUFACTURING CO.

646-Pneumatic switches, valves

Two-page Leaflet 359 describes pneumatic relays and pilot valves, pressure-electric switches, and electric pneumatic valves. Included are gradual direct acting relays, gradual reverse acting relays, and gradual retarded, advanced, and mini-

mum pressure relays. THE POWERS REGULATOR CO.

Vibration and noise control

647-Vibration engineering specs

Complete specifications and performance data for vibration, shock, and noise control products are available in Bulletin K4A. Eleven different types of vibration isolating units are presented. Detailed discussion of the relative merits of of springs and organic materials as isolating media is included with easy-to-read selector chart. Four pages. KORFUND CO.

648-Silence with snubbers

Explosion resistant snubbers, known as the BEC, BES, and BEO lines, for commercial, standard, and optimum silencing respectively, are described in eight-page Bulletin 252. Each type is shown in an elevation drawing accompanied by photos of typical installations in industry. BURGESS-MANNING CO.

649-Vibration isolator features

Features and uses of the Type 5200 shock and vibration isolators are given in eight-page booklet 541. Graphs give data for isolator loads, shock transmissibility, vibration transmissibility, and coupled natural frequencies. Attachment and installation instructions are provided. THE BARRY CORP.

Water supply and treatment

478-How to supply your own water

Methods of abstracting water from the ground or by infiltration through permeable beds of rivers or other bodies of water are discussed in 20-page bulletin. Performance charts for this company's collector are supplemented with cross-sectional drawings and cut aways. RANNEY METHOD WATER SUPPLIES, INC.

479-Demineralization principles

"Demineralization including Silica Removal by Ion Exchange," 28-page Booklet 3803, describes applications, principles of operation, and gives recommendations for demineralizing and silica removal apparatus and synthetic resins. THE PERMUTIT CO.

658-Demineralizing handbook

"Handbook on Demineralizing," 40-page Bulletin 5800-B, compares various methods of water treatment including demineralizers and evaporators. It goes into characteristics of various types of available cation and anion exchange resins and operating costs. COCHRANE CORP.

661-Acid on cooling towers

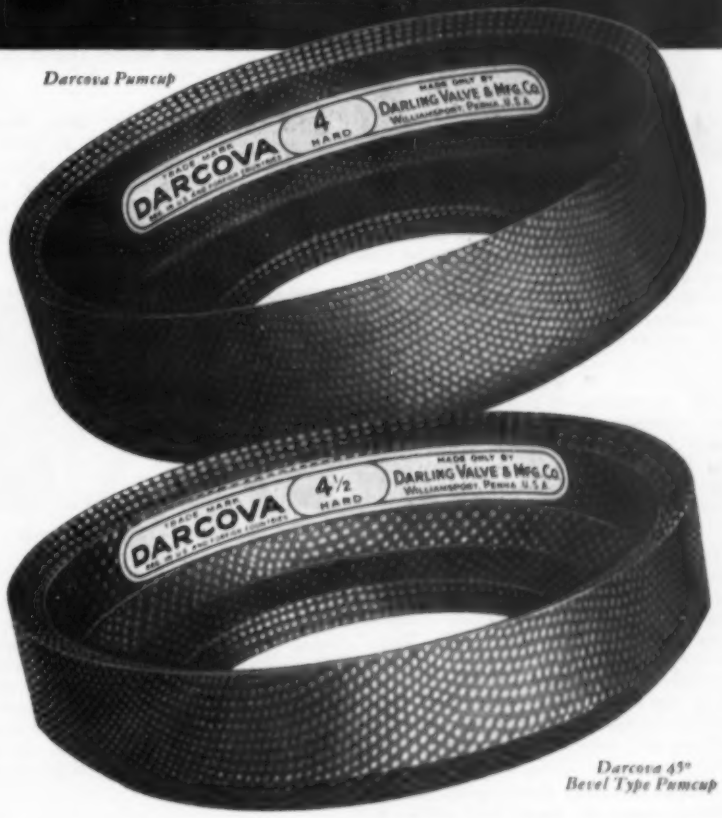
Discussion of how chemical and bacteriological attack can be controlled by acid treatment and wood preservatives to kill fungi appears in Technical Paper No. 130. A good reference work for anyone interested in cooling towers. Eight pages. W. H. & L. D. BETZ.

DARCOVA PUMCUPS

now available with

100% NYLON COMPOSITION

for HYDRAULIC CONTROLS, AIR CYLINDERS, RECIPROCATING PUMPS



DARLING Pumcups—long noted for unequalled efficiency and life in all kinds of cylinders—are now greatly exceeding their own performance records! The new 100% Nylon Composition, available *only* in Darcova Pumcups, does it!

Nylon Pumcups are made in sizes, types and textures exactly right for your particular equipment—ready *now* to give you unprecedented piston packing performance!

Write for helpful data Bulletin No. 5503.

DARLING VALVE & MANUFACTURING CO.

Williamsport 9, Pa.

DARCOVA

TRADE MARK

PUMCUPS

Circle 138 on READ-N-CIRCLE card for more data

names make news

. . . personalities from industry & power

DeLaval Steam Turbine Co. has announced the retirement after 40 years of service of **Charles E. Coleman,** assistant chief engineer of the pump department.

Cheyney

Smaardyk

National Association of Fan Manufacturers, Inc., elected its officers for the year at its recent Annual Meeting. **C. C. Cheyney** (vice president of Buffalo Forge Company) becomes president, **I. W. Nelson** (vice president of American Air Filter Company, Inc.) becomes vice president, and **G. W. McCormick, Jr.** (National Association of Fan Manufacturers, Inc.) becomes secretary-treasurer. **H. E. Barth** (American Blower Corporation) and **R. G. Lubinsky** (The Trane Company) were elected to the Association's board of directors.

Edward Valves, Inc. has appointed **Abraham Smaardyk,** formerly associate engineer in nuclear reactor design at Argonne National Laboratory, as associate director of its expanding Nuclear Engineering department. At Argonne, Smaardyk worked in nuclear engineering, covering the design of reactors, fuel technology and heat transfer, reactor physics, and experimental nuclear physics.

Cooper-Bessemer Corporation has appointed **James W. Reed,** vice president, as Pacific Coast manager. He will be in charge of the company's offices in Los Angeles, San Francisco, and Seattle.

Socony Mobil Oil Company, Inc. has elected new officers. **B. Brewster Jennings** becomes chairman of the board, succeeding **George V. Holton,** who retired July 1. **Albert L. Nickerson** becomes president in succession to Jennings. **Austin T. Foster** and **Paul V. Keyser, Jr.** were elected directors.

American Institute of Electrical Engineers has presented **Aldo M. deBellis,** engineer with **Consolidated Edison Company,** with the 1954 Lamme Gold Medal —one of engineering's highest awards. DeBellis was honored for his "contributions to the design and development of power station equipment—especially air-insulated, phase-isolated, metal-clad, high-voltage bus structures and disconnecting switches."

National Bureau of Standards has appointed **Dr. Ralph P. Hudson** as chief of the Cyrogenic Physics section of its Heat and Power Division. He will direct a broad program in basic research on the properties of matter and the temperature scale in the liquid helium region (1 to 4 Kelvin) and below.

The Chesapeake and Ohio Railway Company has appointed **T. H. Duffy,** as general fuel service engineer to succeed **Minott Brooke,** who retires after 21 years' service. **A. S. Morton** becomes fuel service engineer. **C. S. Dennis** becomes assistant fuel service engineer.

Peitosalo

Taylor

General Electric Company has appointed **Bertram W. Mahoney** as general manager of its Industry Control department in succession to **C. A. Salmonsen,** who will be assigned to special projects in other departments. **Arthur E. Peitosalo** has been appointed manager of specialty capacitor sales. He will replace **D. J. Harrington,** who becomes manager of marketing for the Appliance Control department.

Permutit Company has appointed **George W. Taylor** as chemical research engineer in the Special Applications department. He will devote his time to the application of ion exchangers and equipment in fields other than water conditioning.

American Society of Mechanical Engineers advises that **Rear Admiral Hyman George Rickover** has been named to receive the ASME George Westinghouse Gold Medal Award. Adm. Rickover is chief of the naval reactors branch, AEC Division of Reactor Development and is director of the Nuclear Power Division, Bureau of Ships. He is being honored thus "for eminent achievement in the power field of mechanical engineering, as exemplified by the successful completion of the submarine U. S. S. Nautilus, in which—by his foresight, determination, and leadership—the idea of nuclear power generation was transformed from speculation to reality."

Mine Safety Appliances Company advises that **John B. Davies,** manager of its industrial sales, has been elected president of Industrial Safety Equipment Association. He is a member of the American Society of Safety Engineers, the American Industrial Hygiene Association.

Diesel Energy Corporation has elected **Maximilian B. Bauer** as a director and vice president. He is a graduate of Vienna University, and a former managing director of Eveg. G. m. b. H. (electric bulb manufacturers) in Vienna and of Lux Lamps Ltd., Calcutta, India.

Borg-Warner Corporation has announced the resignation of **John W. De-Lind, Jr.** as chairman of the board of Borg-Warner International Corp., and his retirement from executive duties with the company. He was president of Borg-Warner International from 1946 through 1954.

University of Pennsylvania announces that **Richard S. Reynolds, Jr.,** who is president of Reynolds Metals Company, has been elected a term trustee of the University. He succeeds **Dr. Alfred H. Williams,** president of the Federal Reserve Bank of Philadelphia who has been elected as a life trustee in succession to the late U. S. Supreme Court **Justice Owen J. Roberts.**

Phillips

Jost

Meridan Corporation has appointed **Robert W. Phillips** as chief engineer of its Flex-O-Tube division. Phillips, who is an authority in the hydraulics field, serves as chairman of the Aeronautical Hose and Fittings committee of the Society of Automotive Engineers and also as chairman of the SAE Power Steering committee.

Kewanee-Ross Corporation, Ross Heater Division, has acquired the services of **John A. Jost** as heat exchanger develop-

ment engineer. He was formerly with Foster-Wheeler Corporation, where he specialized in Karbate heat exchangers.

Hall Laboratories, Inc. announce that **Dr. Everett P. Partridge,** director of the company, has been presented the 1955 Max Hecht Award of the American Society for Testing Materials in recognition of his 30 years of contributions to the technology of industrial water. He is a past chairman of the Joint Research Committee on Boiler Feedwater Studies, and has been active as a member of the High Purity Water committee of the National Association of Corrosion Engineers and the Intersociety Corrosion committee.

Beckman Instruments Inc. has disclosed purchase of the **Liston-Becker Instrument Co.** Liston-Becker is a leading manufacturer of infrared gas analyzers. **Max D. Liston,** internationally known infrared authority, will continue as manager of the Liston-Becker operation.

Colorado Fuel and Iron Corporation has appointed **Neil E. Kile** as plant manager of its Clinton, Mass. plant. He was formerly sales and product manager of the Mechanical Specialties department. He will be succeeded there by **Ralph W. Ramer** of Mid-Western district sales.

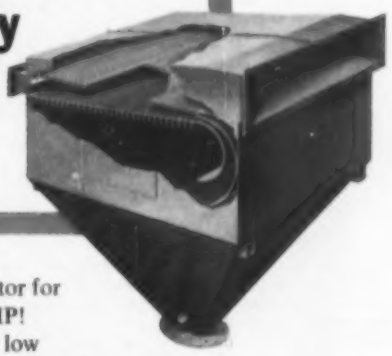
National Association of Corrosion Engineers has named **C. P. Larrabee,** Applied Research laboratory, United States Steel Corp., as chairman of the Technical Practices committee of the association. **E. P. Greco,** senior research chemist, Research department, United Gas Corp., has been named vice chairman.

Byron Jackson Co. has reorganized and expanded its Mechanical Seal Product division. **H. E. Tracy** has been named manager. **D. F. Strang** becomes product manager of the new division. **R. E. Farrell** will work on seal development, both in the engineering department and the laboratory.

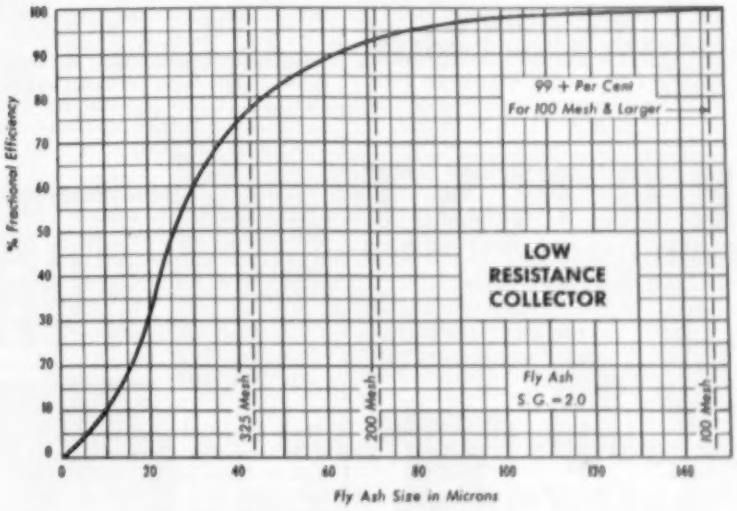
Parker Pen Company has named **L. Jack Bennett,** chief process engineer, to the post of general superintendent. He replaces **Charles Fiora,** who is joining the Gilman Engineering & Mfg. Co. **Edward H. Grumich** has been transferred from the research division to the manufacturing division, where he will be in charge of all engineering.

Allis-Chalmers Manufacturing Company has appointed **Emil Gross,** chief engineer of its Hydraulic department, as consulting engineer. He has been associated with the company for more than 45 years in the design and construction of large hydraulic turbines. He holds several patents on improvements relating to hydraulic turbines and butterfly valves. Successor to Gross as chief engineer is **Paul D. Hess. Frank E. Jaski** has been appointed engineer-in-charge of pump-turbines. **Alvin R. Klaas** becomes manager of product sales. **F. J. Geiger**

New Buell "LR" Fly Ash Collector... Top Efficiency on a Natural Draft!



Here's the ideal dust collector for boilers from 100 to 2000 BHP! Designed for extraordinarily low draft resistance, the "LR" Collector has proved effective on *natural,* as well as *forced* draft installations. Delivers top efficiency in collecting all kinds of cinder discharge, 100-mesh and larger!



WRITE TODAY for new Brochure. Gives complete design and performance data about the new "LR" Dust Collector. Or ask for an on-the-spot survey of your particular collection problem. Dept. H-90, Buell Engineering Company, 70 Pine Street, New York 5, New York.

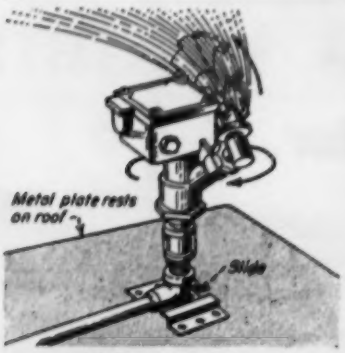
buell

MECHANICAL ELECTRICAL

Experts at delivering Extra Efficiency in

DUST COLLECTION SYSTEMS

Circle 100 on READ-N-CIRCLE card for more data



ROOF COOLING

Best Way to Reduce Air Conditioning Costs

Everyone knows how the sun, beating down on the roof of a building, descends into the interior. Even with insulation, this imposes a big load on air conditioning.

Roof cooling is the answer. It can be used on any roof to keep the building cooler and save air conditioning costs. Best equipment for the job is Ruppright's Rotary Roof Cooler. Easily installed, it produces a thin film of water on the roof. This film evaporates but is continuously renewed by the slowly-rotating cooler making the roof cooler than the air.

WRITE FOR FREE FOLDERS

RUPPRIGHT'S ROTARY ROOF COOLER

P.O. Box 6795 Ip, Los Angeles 22, Calif.

Circle 102 on READ-N-CIRCLE card

ERNST

SIGHT FLOW INDICATORS

"See What Goes On Inside"

For insertion into pipe

FOR EVERY APPLICATION

BRONZE, IRON, STEEL, STAINLESS STEEL

FIG. 29 Cylinder with Impeller

FIG. 17-28 Cylinder

FIG. 215 Flanged

FIG. E-57 Double Window

FIG. 212 Visibility Welding Neck or Screw

FIG. E-811 Flapper

FIG. E-1810 Rotating Wheel Type

All sizes up to 6" *Send for Catalog*

ERNST WATER COLUMN & GAGE CO.

LIVINGSTON, N. J.

Circle 126 on READ-N-CIRCLE card

names make news

. . . starts on page 80

has been appointed general manager of the Norwood, Ohio works. He succeeds **P. F. Bauer,** recently named general manager of the company's Industrial Equipment division.

DeLutis

Splude

National Electric Products Corporation has appointed **Thomas DeLutis** as chief wire and cable engineer. He will be responsible for the design and production of wire and cable products. **Conrad B. DeSautels** has been appointed research and development engineer of wire and cable.

Stearns Magnetic Inc. has appointed **Keith G. Splude** as divisional sales manager of its Brake division. He was formerly an application engineer at the Louis Allis Company.

Westinghouse Electric Corporation has elected **Charles H. Weaver** vice president with responsibility for all Westinghouse atomic power activities. **Edward J. Barakauskas,** development engineer for the Aviation Gas Turbine division research department, has been awarded the Benjamin Garver Lamme Graduate Scholarship. The scholarship is valued at about $2500, plus other allowances.

Dow Chemical Company has appointed **S. G. Sevougian** as manager of its Framingham, Mass. plant. He has been with Dow since 1945, serving as chemical engineer, and later as area superintendent at the Gardena styrene plant.

Morse Chain Company has appointed **Donald H. Spicer** as vice president in charge of sales. **Chester J. Spacher** has been named sales manager of the Chain Drive department. **Robert J. Koch** has been appointed field sales manager for the company.

Cleveland Pneumatic Tool Company has appointed **John J. Bregan** as general sales manager. He joins the company after 20 years with Jefferson Electric Co.

Detroit Edison Company has promoted **Edward R. Moore** from assistant manager to manager of engineering. He will be responsible for design engineering, engineering coordination, planning and project engineering, engineering laboratory and research, and nuclear power development. He will also serve as chairman of the Load Study committee, and as a member of the Rate Development committee. He succeeds **Howard P. Seelye** who retired July 1 after 39 years of service with the company.

Johnson Service Company has elected **M. P. Rather** a director of the company. He is also Eastern district and export manager with headquarters in New York.

Lindberg Engineering Company announces the appointment of **Norbert K. Koebel** as manager of its Heat-treating Furnace division. Beside directing activities of an expanded research and development department, he will supervise technical sales, application engineering of heat-treating processes and equipment, and will be chief technical advisor to associate companies in Europe, and the Orient.

The Texas Company has elected **James W. Foley** as executive vice president of the company.

International Nickel Company, Inc. has opened a Southeast States technical field section development and research division, with headquarters at Atlanta, Ga. **Richard J. Greene,** metallurgist, is in charge of the section.

Jones & Laughlin Steel Corporation has appointed **David L. Doty** assistant to the director of technical services. From 1939 to 1950 he was a metallurgical investigator, a metallurgical supervisor, and also a salesman with the Tin Mill Products division.

Warner Electric Brake & Clutch Co. has appointed two new vice presidents. **Norman K. Anderson,** formerly general sales manager, is now vice president in charge of sales. **King DeSeve,** formerly manager of manufacturing, is vice president of operations.

Nyce

Wallace

Electric Storage Battery Company announces the retirement of **Wallace E. Nyce,** manufacturing manager, after 43 years with the company.

Houdaille-Hershey of Indiana, Inc. has elected **Charles J. Wallace** as vice president and general sales manager. He has had extensive experience in all phases of the filtration industry.

next month in
INDUSTRY & POWER . . . .

GM saves money and gets better lighting by frosting its windows!

Like to learn how to save $18.80 per kilowatt of installed lighting? Supervisor of plant engineering at General Motors' Detroit Diesel Engine Division tells all the detail of investigations his staff made into frosting windows and skylights. The figures looked good, so the windows were cleaned and frosted. The anticipated savings materialized. Lighting was greatly improved. The final measure of success lies in the fact that many more GM plants are now frosting their windows, too.

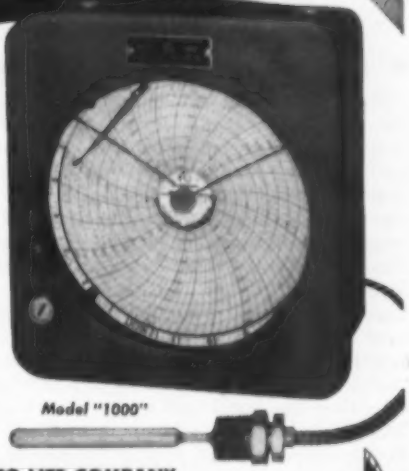
watch for the September issue INDUSTRY & POWER

AUTO-LITE

TEMPERATURE RECORDING...

Newly designed, Model "1000" Auto-Lite Recorder gives permanent proof of temperature behavior. • 6" clear reading chart; various standard ranges from minus 40°F. to plus 550°F. • 3 standard types; choice of 24-hr. or 7-day cycle. • Electric or mechanical chart drive. • With capillary tubing for remote reading. Priced from $49.50.

Send for new catalog describing many styles of Auto-Lite temperature Recorders and Indicators.



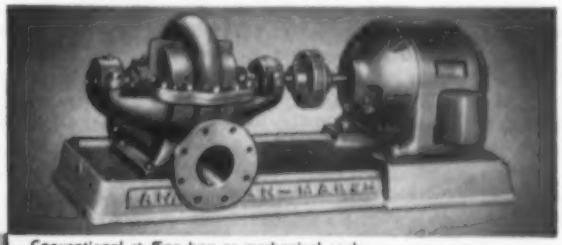
Model "1000"

THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION
TOLEDO 1, OHIO
NEW YORK • CHICAGO • SARNIA, ONTARIO

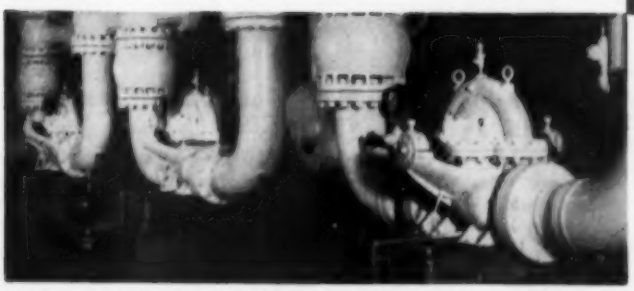
TEMPERATURE RECORDERS

Circle 125 on READ-N-CIRCLE card for more data

Install American-Marsh
PUMPS LIKE THIS



Conventional stuffing box or mechanical seals.



Above — Three bronze-fitted American-Marsh Centrifugals, with direct drive 150 HP motors, each circulate up to 2,000 GPM of chilled water in air conditioning system.

on vital heavy-duty
JOBS LIKE THIS
FOR PERMANENT SATISFACTION!

WHEN YOU SELECT or recommend an American-Marsh Pump, you know it's backed by 80 years' experience in building pumps — and pumps only! WHEN YOU INSTALL it, you know it was individually factory tested to meet all specifications before shipment. (*Every* A-M pump is fully tested!) IF YOU'D LIKE suggestions on the best type and size for *your* job, call your American-Marsh representative. He'll help make sure *your* pump gives permanent satisfaction!

WRITE FOR BULLETIN 350 for details of Model HLM above — or describe your application.

AMERICAN-MARSH PUMPS
BATTLE CREEK MICHIGAN
In Canada:
American-Marsh Pumps (Canada) Ltd., Stratford, Ont.

CENTRIFUGAL, TURBINE, STEAM AND POWER PUMPS FOR TESTING, PROCESSING, BOILER FEED, FIRE PROTECTION, ETC.

Circle 135 on READ-N-CIRCLE card for more data

spot news

. . . . about industry & power

• More new facilities abuilding

National Aniline Division of Allied Chemical is having the Girdler Company design and erect a combination hydrogen and carbon monoxide manufacturing plant at the company's Moundsville, West Virginia works. . . . Sangamo Electric Company will build a new manufacturing plant, having some 100,000 square feet of floor space and employing 500 workers, in Pickens, South Carolina. . . . Timken Roller Bearing Company will spend $850,000 for further expansion of its Bucyrus, Ohio productive facilities. . . . Rockwell Manufacturing Company will spend over $1,000,000 exclusive of production equipment, for a new 104,000-square-foot parts plant in Russellville, Kentucky. . . . Continental Motors Corporation's Canadian subsidiary has purchased a nine-acre tract at St. Thomas, Ontario, Canada for a new plant that will initially occupy 30,000 square feet and employ 200 people. . . . Barber-Colman Company has just completed construction on a 125,000 square-foot facility for manufacturing. . . . The American Brass Company just broke ground for a $2,500,000 plant in Mattoon, Illinois for manufacture of flexible metal hose and tubing.

• Debunk automation bogey

Alarmist assertions that automation will throw people out of work were termed "false and misleading" by Athel F. Denham, industrial analyst. He says that the surest way to throw men out of work is to stop mechanizing industry. "In every year," says Denham, "since 1910 and before, employment of production workers has followed the rate of mechanization or automation like a shadow. When the rate of mechanization goes up, so does employment. When the rate of mechanization goes down, so does industrial employment. . . ." Close on the heels of this pronouncement comes news from Westinghouse that they are building "the most highly automatic of any of [Westinghouse's] plants" at Youngwood, Pa. The products to be produced "are the result of a demand for greater automation in the nation's factories. . . . The 400 or 500 people we will employ by late 1956, therefore, will have jobs created by automation."

• Company line-ups continue changing

General Cable Corporation has acquired the General Insulated Wire Works, Providence, Rhode Island. This adds a group of wire products to the General Cable line that is used extensively in the appliance, business machine, portable machine, and similar equipment industries. . . . Panellit, Inc., Skokie, Illinois has formed the Canadian affiliate—Panellit of Canada, Ltd. The new organization will parallel the parent firm's activities in engineering, design, and fabrication of industrial control systems. . . . Johns-Manville Corporation has changed the name of its "Van Clef Division" to the "Dutch Brand" to further identify this division's products with the parent firm's promotional programs. . . . Consolidated Engineering Corporation, Pasadena, California has set up a worldwide sales organization to meet the growing demand for industrial control equipment overseas. Representatives in 19 countries have been appointed covering Europe, the Far East, Australia, Africa, the Near East, and the Caribbean-Latin America areas. . . . Stephens-Adamson Mfg. Co., Aurora, Illinois has set up 13 authorized stocking distributors throughout the country to handle the company's line of belt conveyor idlers and return rollers, centrifugal loaders and pilers, car pullers, winches, and allied conveyor machinery.

• Call for water resources board

In its recent report on water resources and power, the Hoover Commission called for transforming existing agencies into a Water Resources Board under the executive office of the President. This board would be headed by a nongovernment chairman and would include five public members chosen for their recognized ability in the field. The board would determine broad policies for recommendation to the President, and would have the further duty to devise methods of coordinating plans and actions of the agencies both at the Washington level and in the field. The Commission points out that our industrial water needs, including cooling water, will rise in the next 25 years by an estimated 138,000,000,000 gallons a day. Adding another 7,000,000,000 gallons per day in domestic consumption, the total prospective increase thus seemed to be equal to the additional supply of 147 New York cities, requiring the flow of about eleven Colorado rivers. "Our national policies," the Commission asserts, "must provide for the development of our water resources. Parts of that development require the construction of multiple purpose, water storage dams for irrigation, navigation, or flood control. The production of power will be a necessary byproduct."

• Industry breaks safety records again

Workers employed by the member companies of the National Safety Council chalked up their eighth consecutive year of record-breaking safety performance in 1954. Information just released shows that a reduction was achieved in both frequency and severity of accidents. The average accident frequency rate for all employees dropped three percent from 1953 levels. The 1954 rate is just about half of the 1946 rate. The 1954 average accident severity rate dropped four percent from the 1953 level.

• Intermediate alloy for high-temperature operation

The Alloy Casting Institute has released new information of great interest for powerplant people and others interested in high-temperature equipment. Work sponsored by the Alloy Casting Institute at Battelle Memorial Institute was reported to the ASTM regarding an alloy, designated as HF grade, that can substitute effectively in tem-

All Air-Cooled Dry-Type Transformers are NOT Alike

This was proved by tests, comparisons and experiences

THAT there is a difference in dry-type transformers was revealed in the findings of a survey made by *Plant Engineering*, a trade publication, which mailed 500 questionnaires to users of dry-type transformers. (A copy of this survey report will be sent on request.)

Most of the users who returned questionnaires reported having very favorable experiences with air-cooled dry-type transformers. A number of unfavorable reports listed the following reasons: "Some makes won't even handle their rating." "Some are very noisy." "Primary shorts." "The insulation breaks down without overload in relatively short time." Some recommended "mounted lugs for connections."

The unfavorable comments above *do not apply* to Sorgel air-cooled dry-type transformers.

SORGEL air-cooled dry-type transformers are guaranteed to carry the full rated load continuously, and are so liberally designed that they can safely carry an overload during an emergency. They are well known for their quiet operation. All are equipped with solderless terminal lugs.

Because these superior features cost more to incorporate in Sorgel air-cooled transformers, our price may not always be the lowest; however, the little additional price you might sometimes pay will be saved several times over, in extra service and lower installation costs.

We spare nothing to maintain the highest quality in our air-cooled dry-type transformers.

SORGEL air-cooled dry-type transformers are top quality time-tested and are therefore recognized and accepted by discriminating engineers and users.

These transformers are available in a large variety of sizes and types for every purpose. ¼ Kva to 2500 Kva single phase. 1 Kva to 3000 Kva 3-phase. All standard voltages, such as 120, 208, 240, 480, 600, 2400, 4160, 4800, 7200, 13,200, and up to 15,000 volts, and any intermediate or special lower voltages.

SORGEL dry-type transformers are also incorporated in substations, complete with primary and secondary switchgear.

The Sorgel Electric Co. has 40 years of continuous experience in the development, manufacturing and application of dry-type transformers.

Stock carried by jobbers in the following cities:

New York, N.Y.	Chicago, Ill.	Cedar Rapids, Iowa
Buffalo, N.Y.	Rock Island, Ill.	Davenport, Iowa
Roxbury, Mass.	Rockford, Ill.	Omaha, Neb.
Philadelphia, Pa.	Richmond, Ind.	Beaumont, Texas
Cincinnati, Ohio	Louisville, Ky.	Los Angeles, Calif.
Cleveland, Ohio		

Consult the classified section of your telephone directory or communicate with

SORGEL ELECTRIC COMPANY

841 WEST NATIONAL AVE., MILWAUKEE 4, WIS.

Circle 115 on READ-N-CIRCLE card for more data

spot news

. . . . about industry & power

perature ranges of 1200 F to 1600 F where 25-percent chromium, 12-percent nickel alloy is now used. The new alloy, 21-percent chromium and 10-percent nickel, saves as much as 20 percent in the amount of nickel per casting. At 1400 F, the load-carrying ability of the new alloy is reported to be 14,000 to 15,000 psi for 100-hour rupture life. This new material can thus be used where ordinary steels are no longer useful without jumping to alloys containing large amounts of critical and expensive elements.

• Sign up for biggest boiler in the world

Consolidated Edison Company of New York has signed a contract with Babcock & Wilcox Company under which B&W will design and build the largest boiler in the world for Con Edison's Astoria, Queens station. The unit will have a capacity of 2,400,000 pounds of steam per hour, and will consume over 50 carloads of coal per day. The steam produced will be sufficient to generate between 300,000 and 375,000 kw. Design pressure is 2500 psi. The boiler will be equipped to burn coal, oil, natural gas, or a combination of these fuels. Operation is scheduled to begin in the fall of 1958.

• World's largest, most efficient steam-electric turbine-generator

A super-critical pressure turbine-generator with a nominal rating of 325,000 kw is now being built by Westinghouse Electric Corporation for Philadelphia Electric Company. The $45,000,000 unit was originally planned for only 275,000 kw. At its new rating, it will produce more kwh from a single boiler-turbine unit than any existing or projected powerplant in the world. Operation is expected to begin sometime during 1959.

• Propose federal boost to engineering education

A bill has been introduced before Congress to authorize 25,000 scholarships a year, for eight years, for undergraduate and graduate study of engineering and similar scientific subjects. In connection with another bill aimed at encouraging education, particularly of technical people, Senator Wiley, Wisconsin, is quoted as saying "It is useless to talk about a shortage of engineers . . . . and of other professionals; it is useless for us to talk about our competitive race for technical superiority against the Soviet Union unless we simultaneously take active steps to promote higher education in our land."

• Loans to industry proposed for air pollution control

Legislation is before Congress to permit a maximum of $50,000,000 in loans to industry for air pollution control devices. The loans would be made if adequate financial assistance could not be obtained on reasonable terms from private financial sources. In addition, $3,000,000 for the Department of Health, Education, and Welfare is proposed for a technical research program on problems of air pollution and its abatement.

• Manufacturing construction shoots up 46 percent

Awards for construction of manufacturing buildings during the first half of 1955 totalled $850,085,000, some 46 percent ahead of the corresponding figure for last year. This is the highest for any first half since World War II, excepting 1951 when huge atomic energy awards swelled the total. These figures, covering 37 eastern states, were released by George Cline Smith, economist for the F. W. Dodge Corporation.

The upturn reported by Smith is very broadly based, affecting nearly all major categories of manufacturing. These statistics reflect a very sharp reversal of the downward trend in industrial construction following the Korean War, and reflect trends far beyond the expectations of government and private forecasters. Eighteen of the 23 major categories of industry covered report some measure of increase. Chemicals and allied products were up 140 percent. Sizeable increases were revealed in the stone, clay, and glass products group, primary ferrous metal industries, paper, petroleum refining, printing and publishing, textiles, leather, fabricated metal products, machinery, ordnance and petroleum and coal products. The five categories reporting decreases below last year were food, primary non-ferrous metals, aircraft, electrical machinery and equipment, and miscellaneous transportation equipment.

• FPC figures show industrial generation up 7.9 percent

Federal Power Commission statistics for May 1955 just released show that industrial production of electric power, including generation by railway and railroad plants, increased 7.9 percent over production for the same month in 1954. Total industrial generation was 6,584,769,000 kwh. Total industrial generating capacity was 16,094,615 kw at the end of May. Combined utility and industrial production in May, 1955 was up 14.7 percent over the same period in 1954. For the year ending May 31, 1955, combined utility and industrial generation was up 9.4 percent over the previous year. Combined utility and industrial generating capacity on May 31, 1955 was 122,418,893 kw.

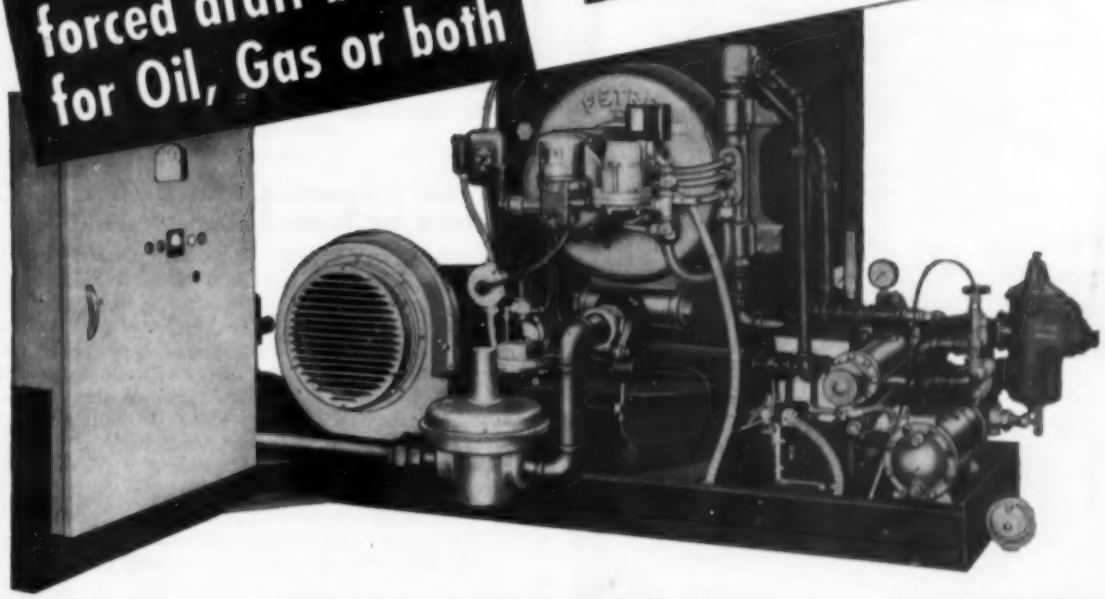
• On the selling front

Modine Manufacturing Company has set up an exchange plan to assist industrial plants in replacing obsolete or worn out unit heaters. The plan permits trade-in

HERE'S BOILER ROOM ECONOMY
from the word "GO"

Petro
forced draft burners
for Oil, Gas or both

A COMPLETE FIRING SYSTEM IN A SINGLE PACKAGE



Quickly converts your present boiler to automatic firing

LOW FIRST COST

This Petro package unit is much more than a conversion burner. It is a *complete* combustion system in which all elements are correctly balanced—and integrated—a thoroughly engineered firing plant.

Includes burner (for oil, gas or combination oil-gas), fuel system, forced draft air supply, control panel, and preformed refractory combustion throat. Installation requires little more than bolting the entire unit to the boiler-front, and making safety and service connections for power and fuel.

ENCLOSED CONTROL PANEL

Neat, safe, and complete—the Petro control panel is totally enclosed with all instruments wired and tested at the factory. Can be attached to frame as shown, turned 90° or 180° or mounted elsewhere in the boiler room.

LOW FUEL COST

OIL—Petro's highly efficient horizontal rotary oil burner is adaptable to the entire range of fuel oil grades. Exclusive Petro Thermal Viscosity System automatically heats the heavier oils before injecting into atomizing cup. Assures quick pickup with sure and economical firing of lower cost fuels.

GAS—Designed for all types of gas—high or low pressure—the Petro circular arrangement of multiple gas jets provides a thorough mixing of gas and air *ahead* of the combustion zone. A real fuel saver. Adaptable to steady or fluctuating load requirements.

COMBINATION OIL-GAS—In one compact unit. Gives alternate stand-by fuel and permits taking advantage of fuel price fluctuations. Fuels can be switched in a matter of seconds.

PETRO
T. M. REG. U. S. PAT. OFF.

Over 50 years of leadership in automatic heating and power equipment

Send for free literature

PETRO, 3225 West 106th Street, Cleveland 11, Ohio.
In Canada: 2231 Bloor Street West, Toronto, Ontario.

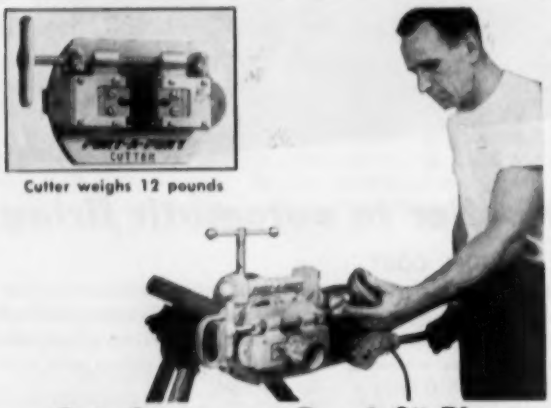
Please send me literature and specification sheets on the money-saving Petro Package Unit.

Name _____
Company _____
Address _____
City _____ State _____

Circle 122 on READ-N-CIRCLE card for more data

CASE HISTORIES PROVE YOU CAN SAVE $ $ $
with
SPRAGUE POWER FACTOR CAPACITORS
• CUT POWER BILLS
• AVOID EXTRA EQUIPMENT
• ALLOW BIGGER LOADS
• PROVIDE PLANT FLEXIBILITY
Thousands of installations throughout industry are proving daily that Sprague Power Factor Capacitors installed at each piece of inductive electrical equipment eliminate waste current *right at the source.* Power factor is corrected to the maximum, allowing a greater load at reduced power cost. Need for extra wiring, switchgear, and transformers is often avoided, and plant expansion or moves can be made at minimum cost. *Write for Free 28-page Power Factor Correction Guide.*
SPRAGUE
Industrial Capacitor Div.
SPRAGUE ELECTRIC CO.
351 MARSHALL STREET
NORTH ADAMS, MASS.

Circle 116 on READ-N-CIRCLE card for more data



Cutter weighs 12 pounds

Cut, Groove, or Bevel 2" Pipe

right on the job . . . in 30 Seconds!

The Port-A-Pony Pipe Cutter gives a clean beveled cut on ½" to 2" pipe that's easy to thread and easy to join.

Attaches to the Port-A-Pony Power Drive in 10 seconds.

Blades are quickly changed. Exclusive Safety Guide prevents gouging and burring.

Get all the facts—write today for full information.

THREAD-EZY MFG. COMPANY WRITE FOR DETAILS

340 North Brody Street Corunna, Michigan

Circle 131 on READ-N-CIRCLE card for more data

spot news

. . . . about industry & power

of old unit heaters on new Modines of an equivalent size and type at a liberal exchange price. Provision is also made for re-use of old motors still in good operating condition. . . . Babcock & Wilcox Company announces revised price schedules covering seamless carbon, alloy, and stainless mechanical and pressure tubes. The new prices reflect increases in costs due to rising labor rates and raw material prices . . .

General Electric Company will continue its policy of supplying insulating oil even though another electrical manufacturer has suggested that customers buy direct from refineries. Oil used to insulate and cool transformers, voltage regulators, switchgear, and other electrical apparatus is an integral part of apparatus design. A GE spokesman says, "We cannot afford to gamble with unproven oil, nor can we sanction its use by customers who have large investments in electrical apparatus at stake."

• Fuel pioneering wins Charles A. Coffin Award for Texas P&L

Texas Power & Light Company, Dallas, Texas, was given the Charles A. Coffin Award for 1954 for "extraordinary enterprise and resourcefulness in uncovering and developing the extent and value of untapped natural resources." The Award, made by General Electric Company at the Edison Electric Institute annual convention in Los Angeles was based, among other things, upon the research program of Texas Power & Light for preparing and using lignite in power plant boilers. The citation commanded Texas P&L's investigation as nationally recognized to be of benefit to the industry and the public by opening up the potentialities for economic exploitation of the nation's vast and largely undeveloped deposits of lignite and other low rank, non-coking fuels."

• Steel prices cut by Lone Star

Because its employees rejected a contract that would have forced a price increase in its products, Lone Star Steel Company, Dallas, has revoked price increases and has issued credit memorandums to cover the differences in between old prices and those being voided.

• American Wheelabrator changes its name

American Wheelabrator & Equipment Corporation, Mishawaka, Indiana has changed its name to Wheelabrator Corporation. The name change does not affect the company's operation, management, or ownership.

• Panellit expands engineering facilities

Panellit, Incorporated, Skokie, Illinois, has formed a new Instrument Services Division to fulfill demands for engineering facilities outside the normal range of the company's activities. The new division will provide consulting and installation service in the broad fields of in-

strumentation and automation. This includes system design and project supervision as well as inspection, calibration, check-out and plant start-up. Neil M. Blair has been appointed manager of the new division.

• Westinghouse forms heating division

Westinghouse Electric Corporation has formed an industrial heating division. This division has responsibility for the engineering, manufacture, and sale of resistance and induction heating equipment, plus atmosphere generators. The move is calculated to permit more efficient technical service. Headquarters of the new division will be at Meadville, Pennsylvania. The division will be responsible for the company's induction heating activities now located at Baltimore, Maryland.

• More engineering service for industry

Burns & Roe, world-wide engineers and constructors, have created an Industrial Division with headquarters in Baltimore, Maryland. The new division will offer engineering, design, and construction service for new or expanding plants, facilities, equipments, processes, or functions. Richard W. Black, formerly head of the design and engineering division of the Industrial Corporation, will head the new general division.

• Pacific Northwest has new engineering firm

The Pacific Northwest now has a new firm of engineers offering consulting service to those who are responsible for planning, building, and operating. The firm—Gellert, Griffin, Carey & Associates—is a joint venture of five groups of engineers plus independent associates.

• Release mid-year earnings statements

Allis-Chalmers Mfg. Co. made profits of $12,562,932 on sales of $267,040,844 during the first half of 1955. Those sales were some $8,000,000 ahead of the sales for the same period in 1954. Profits were some $1,000,000 less for the same period in 1954. Earnings were 4.70 percent of sales billed for the first six months of 1955, whereas they were 5.12 percent of sales in 1954. . . . General Electric Company earnings reached an all-time high of $101,892,000 during the first six months of 1955. This is a 9 percent increase over the first half of 1954. The earnings for the first half of 1955 were achieved on sales of $1,523,951,000.

• Dow aids education

Dow Chemical Company is granting $300,000 to educational institutions during the 1955-56 academic year for the advancement of science and engineering. The 1955-56 grants are substantially higher than amounts allocated by Dow in previous years. Part of the thinking behind this program, according to Dow president Dr. Leland I. Doan, is that Dow "has a vital stake in educational development [and] looks to our schools for a continuous flow of trained people to fill technical and other positions."

STOP THAT NOISE!

from Air, Steam and other gas discharges

with

BURGESS-MANNING SNUBBERS

Stop that noise and profit through better neighbor and employee relations. Avoid compensation claims.

Burgess-Manning Snubbers are engineered to effectively correct your specific noise problem.

Tell us your noise problem and let us recommend—no obligation

From a WHAM

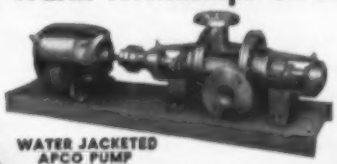
Sound Engineering

BURGESS-MANNING COMPANY

733 East Park Avenue, Libertyville, Illinois
Dallas, Texas

Circle 144 on READ-N-CIRCLE card for more data

Making Warm Friendships on Hot Jobs



WATER JACKETED APCO PUMP

Developed especially for the efficient handling of high temperature and highly volatile liquids. Delivers outstanding performance. Unbeatable on high head, small capacity duties.

APCO Turbine-Type PUMPS

—ideal for "1001" duties where small capacities and high heads predominate. Get acquainted.

AURORA CENTRIFUGAL PUMPS

are available in many types and sizes—all noted for their streamline coordination between impellers and shells.

AURORA Always PUMPS

We Invite Your Special Pump Problems

Write for CONDENSED CATALOG "M"

DISTRIBUTORS IN PRINCIPAL CITIES

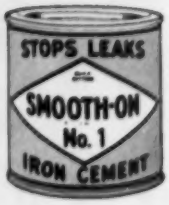
AURORA® PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
42 LOUCKS STREET • AURORA • ILLINOIS

Circle 136 on READ-N-CIRCLE card for more data

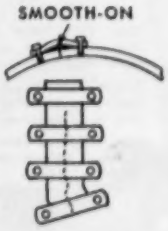
QUICK, LOW COST EMERGENCY

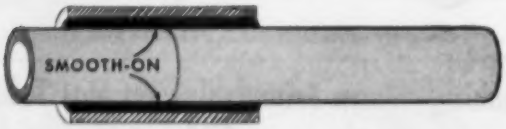
Repairs

When you just *have* to get a boiler, or machine or plumbing system back in working condition fast, Smooth-On Iron Cement saves the day . . . and saves you many dollars, too. It makes the repair quickly. Tides you over until the permanent job can be done.

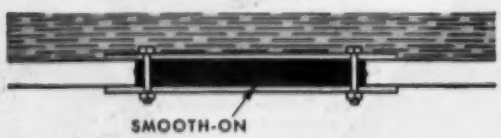


Reinforced Crack Repairs in boilers, water tanks, etc., can be made with Smooth-On No. 1 Iron Cement, as shown. Smooth-On is forced into the crack and a patch plate is then applied over the area with straps held in place by machine screws. As Smooth-On hardens it expands against the patch, making a tight, durable seal.





Emergency Pipe Joint. The same expansion principle applies here. Put the pipe ends into a section sawed from a larger pipe and pack tightly with Smooth-On.



Broken Parts. A broken casting can be repaired temporarily, as illustrated. You make a Smooth-On "sandwich" by bolting on a patch plate at top and bottom.

These are just a few of the many emergency repairs possible with Smooth-On. Better keep a can on hand! Others are described in the *free* Smooth-On Repair Handbook. Ask your supply house for a copy or write us.

SO 410

SMOOTH-ON MANUFACTURING COMPANY

Dept. 19, 570 Communipaw Avenue, Jersey City 4, N. J.

SMOOTH-ON

Circle 129 on READ-N-CIRCLE card for more data

good books

. . . for industry & power

Readers wanting to obtain copies of these books may order through INDUSTRY & POWER. *Send check covering cost and we will forward your orders to the publishers.*

Thermodynamics, by John Francis Lee and Francis Weston Sears; Addison-Wesley Publishing Company: 543 pages; $7.50.

If your appetite for thermodynamics has been whetted by The Thermodynamics Refresher series currently running in INDUSTRY & POWER, you should get a copy of this book. It is coauthored by the writer of I&P's articles. Professor Lee's book represents as thorough analysis of this subject as has been seen in a long time. There is no pussy-footing around the mathematics underlying the conclusions. Thorough derivations are presented for all important equations. If there is one of those vague "it-can-be-shown-that" dodges, it has escaped this reviewer's eye. The illustrations are done in a simple, uncluttered but yet refreshingly different style.

Eighty-five Percent Magnesia Insulation Manual, Second Edition; The Magnesia Insulation Manufacturers Association; 74 pages, paper bound.

This brochure points out the many uses for 85 percent magnesia insulation. After an initial discussion of general principles, it goes into specific application procedures, and concludes with an appendix of valuable reference data.

Power Plant Management, by Robert Henderson Emerick; McGraw-Hill Book Company; 339 pages; $6.50.

Here is an excellent book that deserves space on the active shelf of anyone with responsibility for running a power plant. Three important aspects of managing power plants are covered in most adequate detail: methods and practices in designing and planning the plant, techniques of plant administration, and plant operation itself.

This reviewer's first suspicions were that this was another one of those books built around utility-size power plants, the kind of book that forces the manager of an industrial-size plant to scrounge for whatever scraps of information might be applicable to his particular situation. Such suspicions have no ground in this case. The first three chapters, in particular, are aimed straight at the needs of industrial-size power plant management. These are the chapters covering "to buy power or make it," "selecting the best-suited mode of power generation," and "electrical and miscellaneous problems of design." The balance of the book's 20 chapters do cite utility practice, but in no way do these citations exclude the viewpoint of the industrial power plant manager.

One of the book's greatest assets is its manner of presenting facts. A goodly portion of the material is arranged in tables and numbered paragraph summaries. Information is thereby pinpointed and made easy to find.

reprints available

. . . . from industry & power

Reprints of Special Reports and feature articles that have appeared in INDUSTRY & POWER can be ordered from Reader Service Department, INDUSTRY & POWER, Commercial Bank Building, St. Joseph, Michigan.

Feature article reprints

Reprints of the following articles are available on single copy orders free of charge:

- *A Better Water At Lower Cost*
- *Big Savings For A Small Plant*
- *Boiler Blowdown Control*
- *Bulk Handling as a Business*
- *Burners For Package Boilers*
- *Bring Back Those Blowdown Btu's*
- *Coal Burning Equipment Application and Selection*
- *Coal Dust . . . Stopped Before It Starts*
- *Combustion And Combustion Guides*
- *Demineralization . . . A Means of Purer Water*
- *Economic Limits for Power Factor Correction*
- *Electrically Heated Pipelines Keep Fuel Oil Flowing*
- *Engineered Incineration*
- *Engineered Insulation*
- *Hot Materials Demand Special Conveyor Designs*
- *How Can You Ignore Industrial Water Treatment?*
- *How To Select Corrugated Expansion Joints*
- *Joining Copper and Its Alloys*
- *LP Means Loss Protection*
- *New Chemical Grouting Method Prevents Flooded Floors*
- *Permanent Tank Insulation Costs Less*
- *Profits From Wastes Purchased Vs Generated Power*
- *Put Dissolved Air to Work*
- *Reclaim Your Waste Heat*
- *Reducing Boiler Plant Operating Costs*
- *Selecting Fuel and Firing Equipment*
- *Shell Selects Package Boiler for Outdoor Operation*
- *Short Short-Circuit Calculations*
- *Small Filters Do Big Job*
- *Solving a Fly Ash Problem*
- *Specifying Paint Protection*
- *Spreader Stokers*
- *Synchronous Motors Do Two Jobs At One Time*
- *Television . . . The Eyes Of Industrial Control*
- *Variable Throw Transmissions*
- *Warm And Cold Tank System For Multiple Station Cooling*
- *When to Use Eddy Current Couplings for Speed Control and Clutching*
- *Which Should It Be . . . Electric or Pneumatic Controls?*
- *Will It Pay to Incinerate Your Waste?*
- *Why High Temperature Water?*

Special report reprints

Individual copies of Special Report Reprints will be sent free upon request. Additional copies are priced as follows: 2 to 24 copies are 25¢ each; 25 to 49 copies are 20¢ each; 50 to 99 copies are 15¢ each; more than 99 copies are 10¢ each. Special Report Reprints available are:

- *Adjustable Speed Drives and Electrical Controls*
- *Annual Review and Forecast, 1955*
- *Combating Corrosion From Industrial Chemicals*
- *Contaminants in the Air*
- *Control Valves and Positioners*
- *Demineralization—A Means to Purer Water*
- *Industrial Waste Treatment*
- *In-plant Electrical Distribution*
- *The Packaged Boiler Picture*
- *A Thermodynamics Refresher (Parts I through IV)*

Classified Advertising

SAVE ON RAILS

BUY "GUARANTEED RELAYERS"

Handle more cars better — spend less to install & maintain with Foster Relayers. "Open-stock" shipments, all sections 12# thru 175#. Switch Materials, Track items.

Send catalogs ☐ Rails ☐ Track Equipment
☐ Send Free 'Track Maintenance' Book

RAILS · TRACK EQUIPMENT · PIPE · PILING
L. B. FOSTER CO.
PITTSBURGH 30 NEW YORK 7
CHICAGO 4 HOUSTON 2 LOS ANGELES 5

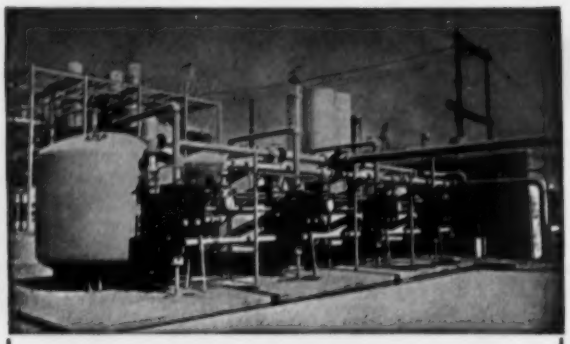
CONVERT TO LP. GAS

Save up to $500 a year per truck

Write to
PEACOCK CORP.
WESTFIELD, N. J.

Master GLASSES
MAGNIFYING
HIGH PRESSURE GASKETS
All sizes to fit your gages
ERNST WATER COLUMN & GAGE CO.
Send for Catalog LIVINGSTON, N. J.

complete Anhydrous Ammonia and L.P. Gas plants
designed - installed
H. Emerson Thomas & Associates, Inc.



75000 GPH FULLY AUTOMATIC WATER TREATMENT PLANT

A Typical H & T Installation

INVERSAND SOFTENING PLANTS
INVERCARB DEALKALIZER PLANTS
PRESSURE & GRAVITY FILTERS
CONDENSATE DE-OILING FILTERS
DEMINERALIZER PLANTS
HOT ZEOLITE SOFTENING PLANTS

And a complete line of water conditioning systems. All sizes, all capacities Manual or Automatic.

New Bulletins D-F, 15-1, DM-1 & SFT-1 Available on Request.

HUNGERFORD & TERRY, INC.
CLAYTON 1, NEW JERSEY

Circle 147 on READ-N-CIRCLE card for more data

INSTANT SETTING CONCRETE FLOOR PATCH

TEST IT ON TRIAL OFFER

TOUGH AS NAILS! FAST!

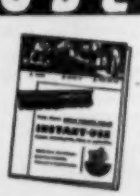
Repair broken factory floors without the usual traffic tie-up. Simply shovel INSTANT-USE into hole or rut—tamp smooth—truck over! No Waiting! INSTANT-USE bonds tight to old concrete—right up to a feather edge. It's tough. Wears like iron. Won't crack or crumble. Install complete overlay where floors are badly chewed up. Used indoors or out. Immediate shipment.

MAIL COUPON for TRIAL OFFER and FREE BROCHURE

INSTANT-USE

PLEXROCK COMPANY (Offices in principal cities)
3605 Filbert St., Philadelphia 1, Pa.

Please send me complete INSTANT-USE information, details of TRIAL ORDER PLAN and Free INSTANT-USE BROCHURE — no obligation. (Clip and attach Coupon to Co. letterhead).



Name .....
Title .....
Company .....
Address .....

Circle 110 on READ-N-CIRCLE card for more data

advertisers' index

Airetool Mfg. Co. ..... *
Allis-Chalmers Mfg. Co. 93
American-Marsh Pumps, Inc. 83
American Water Softener Co. 21
Ames Iron Works, Inc. ..... *
Annin Co., The ..... *
Armstrong Machine Works ..... *
Atlantic Metal Hose Co. ..... *
Aurora Pump Div., N. Y. Air Brake Co. 89
Automatic Electric Co. 9

Babcock & Wilcox Co. Refractories Div. ..... *
Betz, W. H. & L. D. 11
Bigelow-Liptak Corp. ..... *
Bituminous Coal Institute 65
Buell Engineering Co. 81
Burgess-Manning Co. 89
Bussmann Mfg. Co. ..... *
Byron Jackson Co. 94

Chapman Valve Mfg. Co., The 7
Chesapeake & Ohio Railway 33
Cleaver-Brooks Co. ..... *
Coppus Engineering Corp. ..... *

Darling Valve & Mfg. Co. 79
Dart Union Co. ..... *
Dearborn Chemical Co. 3
DeLaval Steam Turbine Co. ..... *
Detroit Stoker Co. ..... *
Diamond Power Specialty Corp. ..... *
Dynamatic Div., Eaton Mfg. Co. 27

Eaton Mfg. Co., Dynamatic Div. 27
Electric Auto-Lite Co., The 83
Electro Hercules Steel Co. ..... *
Elgin Softener Corp. ..... *
Engineer Co., The ..... *
Enos Coal Mining Co. 6
Erie Bolt & Nut Co. ..... *
Erie City Iron Works ..... *
Ernst Water Column & Gage Co. 82
Everlasting Valve Co. 31

Flexrock Co. 92
Foster Co., L. B. ..... *

General Coal Co. 32

Hays Corp. ..... *
Heacon, Inc. ..... *
Heinemann Electric Co. 25
Hennsey Co. ..... *
Hungerford & Terry, Inc. 92

Infilco Inc. 2
I-T-E Circuit Breaker Co. Small Air Circuit Breaker Div. ..... *
I-T-E Circuit Breaker Co. Switchgear Div. 15

Jerguson Gage & Valve Co. ..... *
Johns-Manville ..... *
Johnson Corp., The 66
Johnson Service Co. ..... *

Kalamazoo Tank & Silo Co. 72
Keckley Co., O. C. ..... *
Kirk & Blum Mfg. Co. ..... *

L*A Water Softener Co. 72
La Favorite Rubber Mfg. Co., Inc. ..... *
Leslie Co. ..... *
Liquidometer Corp. 30

Manhattan Rubber Div. ..... *
Manzel, Div. of Houdaille-Hershey Corp. 73
Master Builders ..... *

National Airoil Burner Co. 16
National Coal Association 65
N. Y. Air Brake Co., The Aurora Pump Division 89
N. Y. & N. J. Lubricant Co. ..... *
Niagara Blower Co. 20
Northern Blower Co. ..... *

Petro 87
Pick Mfg. Co. ..... *
Plomb Tool Co. ..... *
Powers Regulator Co. 8
Prat-Daniel Corp. 17
Proto Tools ..... *

Ranney Method Water Supplies, Inc. 29
Raybestos-Manhattan, Inc. ..... *
Republic Mfg. Co. ..... *
Ronningen Mfg. Co. ..... *
Rupprecht Rotary Roof Coolers 82

Sinclair Refining Co. ..... *
Smooth-On Mfg. Co. 90
Sorgel Electric Co. 85
Spence Engineering Co., Inc. 19
Sprague Electric Co. 88
Standard Pressed Steel Co. 66
Strong, Carlisle & Hammond Co. ..... *
Subax, Inc. ..... *
Superior Combustion Industries, Inc. 74

Texas Company, The ..... *
Thermix Corp. 17
Thread-Eze Mfg. Co. 88
Titusville Iron Works, The, Div. of Struthers Wells Corp. 23

Union Iron Works 71
Universal Atlas Cement Co. 63

Vogt Machine Co., Henry 13

Weinman Pump Mfg. Co. ..... *
Wiedeke Co., The Gustav ..... *
Wilson, Thomas C. ..... *
Wing Mfg. Co., L. J. ..... *
Worthington Corp. Vertical Turbine-Industrial Div. ..... *

Yarnall-Waring Co. 34

Where an * appears after a name the advertisement does not appear in this issue, but appeared in one or both of the two previous issues.

AIR AT WORK

New two-stage Ro-Flo compressor provides constant efficiency... cuts maintenance

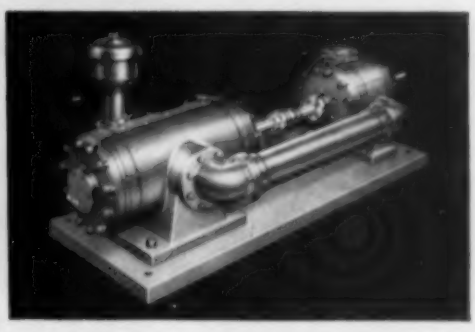
Efficiency and air supply are constant year after year with *Ro-Flo* compressors. Even if wear occurs, it automatically compensates for itself so that air supply is unaffected.

In addition, rotary design eliminates practically all vibration. No heavy foundations are needed.

Maintenance is cut too! There is no wear and tear from shock and vibration . . . no hard-to-maintain pistons and valves.

For constant efficiency . . . overall savings on air, modernize plant air supply with two-stage *Ro-Flo* compressors.

GET THE FACTS: Contact your A-C office or write Allis-Chalmers, Milwaukee 1, Wis.



Two-stage *Ro-Flo* compressors in pressures from 60 to 125 pounds gauge, and volumes from 250 to 1800 cubic feet per minute.

Ro-Flo is an Allis-Chalmers trademark.

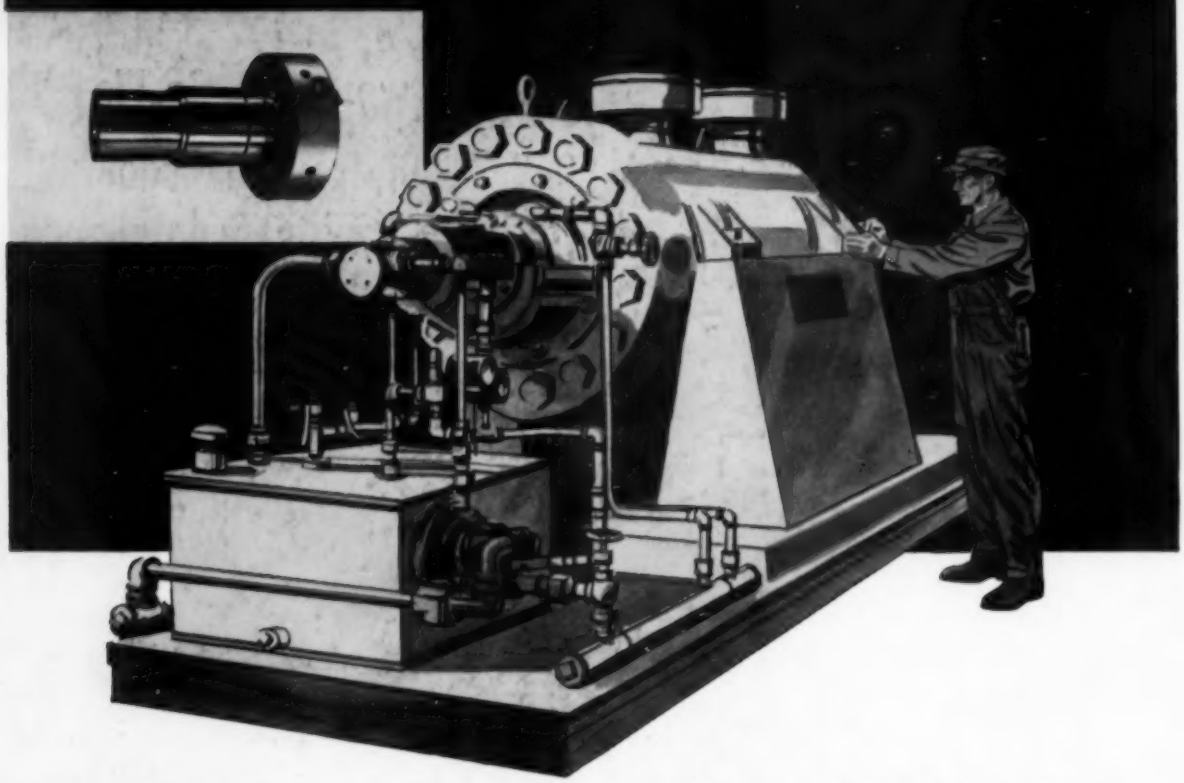
A-C ALLIS-CHALMERS

A-4714

ALLIS-CHALMERS

Circle 103 on READ-N-CIRCLE card for more data

Now... BJ mechanical seals for high pressure boiler feed pumps!



Another Byron Jackson first!

- **No operating adjustment**
- **Stop liquid loss**
- **Reduce heat loss**
- **Save downtime costs**
- **Cut replacement costs**

BJ . . . the pacemaker in mechanical seals for pumps . . . now has pioneered the first successful application of the mechanical seal to high pressure boiler feed pumps. These new BJ Mechanical Seals are now in operation in a number of high pressure, hot water pumping operations, including temperature up to 430° F. These seals—some in service as long as three years—have paid off in performance. They have minimized heat and liquid loss, eliminated frequent repacking problems, and simplified maintenance since no operating adjustment is required. Find out how these new BJ Mechanical Seals for boiler feed pump service can benefit you. Contact your nearby Byron Jackson office or write.

You'll do better with BJ

Byron Jackson Co.

Since 1872

P. O. BOX 2017, TERMINAL ANNEX, LOS ANGELES 54, CALIFORNIA

Circle 137 on READ-N-CIRCLE card for more data